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Rehabilitation of the Injured Chest

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Physicians and physical therapists have become accustomed to concerning themselves with the reconditioning aspects of muscle, bone and nerve injuries of the extremities, and rightfully so. But not enough stress has been placed upon the importance, indeed the necessity, for physical therapy in the treatment of chest injuries.

Thoracic injuries constitute more than eight per cent of all admissions into army general hospitals; that is, about one out of every ten to twelve patients in a base hospital represents chest wounds.[1]

After life-saving measures have been instituted, the goal in the management of thoracic injuries is the restoration of maximum function. In this regard consideration must be given to four distinct sets of tissue: (1) the pleurae, (2) the lung, (3) the diaphragm, and (4) the thoracic cage, consisting of ribs, intercostal and adjacent muscles, the dorsal spinal column and the sternum.

The above-mentioned structures are integrated to form a complicated respiratory mechanism, a basic understanding of which is essential for the proper comprehension of the exercises to be described later. The thoracic cage represents a closed space; its capacity is increased by the movements of the diaphragm and, to a lesser degree, of the costal wall. The lung is the only organ encased in the thoracic cage whose volume can be enlarged or diminished, in the fashion of a sponge being squeezed or expanded. The heart, trachea, esophagus, nerves, et cetera, that together constitute the mediastinal structures, resist changes in their own volume but can be moved as a whole from one side to another within the costal cage. When this occurs, it is known as a "shift of the mediastinum" or "mediastinal shift;" it is fraught with physiologic dangers.

The lung itself is adherently covered by a thin, glistening tissue known as the visceral pleura. The inner side of the costal cage, the mediastinum, and the diaphragm likewise are covered with pleura, known collectively as parietal pleura, and broken down for more descriptive purposes into diaphragmatic pleura, mediastinal pleura, and costal pleura. Although the visceral pleura and the parietal pleura are normally in contact with each other, there exists between them an almost imperceptible "microscopic" negative pressure, so small that it is measured in terms of centimeters of water in contradistinction to the customary use of mercury for measuring pressure. It is this minute suction force, measuring generally -7 cm. mean pressure of water, that plays so important a role in the delicate physiology of respiration.

Respiration is normally a passive act. When the diaphragm contracts it moves down into the abdomen, thereby enlarging the volume of the thorax. At the same time the increased girth of the chest wall likewise assists in increasing this volume. By virtue of the intervening negative pressure (suction force), the parietal pleura, moving down and out, takes with it the visceral pleura which in turn

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pulls the lung down and out. The expanded lung is now possessed of an intrapulmonary pressure less than the atmospheric pressure with which it is in continuity, and so "sucks in" air through its bronchi to equalize the pressure. At expiration the air is "squeezed out" by the inherent "elastic recoil" of the lung tissue, for when the diaphragm relaxes, releasing the pull on the intrapleural negative pressure, as it were, the lung tissue springs back to its "expiration volume," much like a released outstretched rubber band.

It stands to reason that impairment of any of the parts involved, no matter how seemingly trivial, will result in a disturbance in the mechanism of respiration. Indeed, very often the simplest of wounds produce the most devastating effects, as in a sucking wound, to be discussed later.

For the purpose of classification, thoracic wounds are divided into nonpenetrating and penetrating wounds. These descriptive terms are made in reference to the continuity of the parietal pleura; that is, wounds which do not disrupt the parietal pleura are classified as nonpenetrating; those that lacerate it, penetrating. Though the latter is much more prevalent, both nonpenetrating and penetrating wounds may cause injury to any of the thoracic structures. The pathology commonly met with is as follows:

1. Involvement of the Pleurae

A. Pneumothorax (Fig. 1)

As the name implies, in this condition air resides within the thoracic cage, but this is not construed to mean within the lung parenchyma. Rather, the air has gained access into the potential space that normally exists between the visceral and parietal pleurae. The negative pressure is not only equalized by the invasion of the air but actually the intrapleural space is generally greatly enlarged, filled with air, and a varying degree of positive intrapleural pressure ensues. Since the thoracic cage is more or less fixed, the capacity for expansion of the lung is markedly restricted by the intrusion of the air into the thorax, and the respiratory mechanism is thereby impaired. Moreover, since there no longer exists a negative intrapleural "suction" pressure, the pull of the diaphragm upon the lung is largely wasted, as is the effect of costal cage motion.

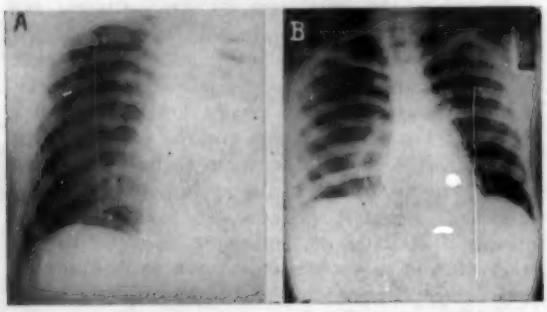

Figure 1. (A) Right-sided pneumothorax and left-sided postoperative atelectasis. The pneumothorax was found to be under tension with an intrapleural pressure of plus 6. It is represented on the x-ray by the lateral area of increased illumination devoid of lung markings. The atelectasis is denoted by the large area of increased density over the left lung fields, and retraction of the mediastinum. (B) Appearance of chest 13 days later. The tension pneumothorax was treated by intercostal waterseal drainage, the atelectasis by bronchoscopy. Both lungs are now completely reexpanded. Remedial breathing exercises were instituted mainly for the correction of poor diaphragmatic excursion and a right-sided partially immobilized thorax.

Pneumothorax may be caused by one of two mechanisms:

(1) The parietal pleura may be lacerated by a penetrating shell fragment or gunshot wound, admitting air through the chest wall. Generally, the adjacent and involved soft tissues fall together over the wound after the penetration and seal off the chest wall from continued ingress of air. But in about 20 per cent of the cases so-called sucking wounds occur; the hole in the chest wall remains patent, permitting the free passage of air in either direction, and resulting in a condition known as "open pneumothorax." With each inspiration air is drawn into the thorax through the wound, as well as through the glottis, in amounts depending on the size of the chest wall deficiency. Obviously, the extrapulmonary, intrathoracic air stands no chance of being oxygenated for use by the circulatory system. Moreover, as increased amounts of air occupy the intrapleural space, the lung on the affected side is subjected to increased collapse and the mediastinum to progressive shift.

When the soft tissues have been lacerated in such a manner that they act as a one-way valve, air is admitted into the thorax with each inspiration but is not permitted to escape with expiration. As more and more air is introduced into the thorax with each respiration, a "tension" pneumothorax (Fig. 1) is built up, and the intrathoracic structures are pushed away before it and are subsequently compressed within the thoracic cage.

(2) Pneumothorax also may result from disruption of the visceral pleura together with a tear of the lung parenchyma. Air from the lung tissue escapes into the intrapleural space. Again, if the laceration acts as a one-way valve, a tension pneumothorax results. Pneumothoraces caused by this mechanism may be due to a fractured rib whose ragged edges pierce the lung, or by blast injuries, in which case the concussion force causes a tear of the lung even though there is no visible external wound.

Uncomplicated mild or moderate pneumothoraces

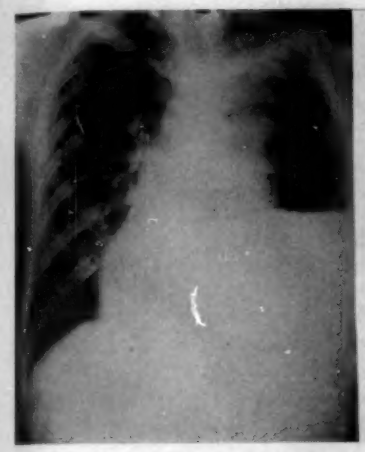

Figure 2. X-ray of chest demonstrating a left-sided hemopneumothorax. Note the transverse fluid level of the hemothorax. Above this lies the pneumothorax and the left collapsed lung. The mediastinum is displaced to the opposite side.

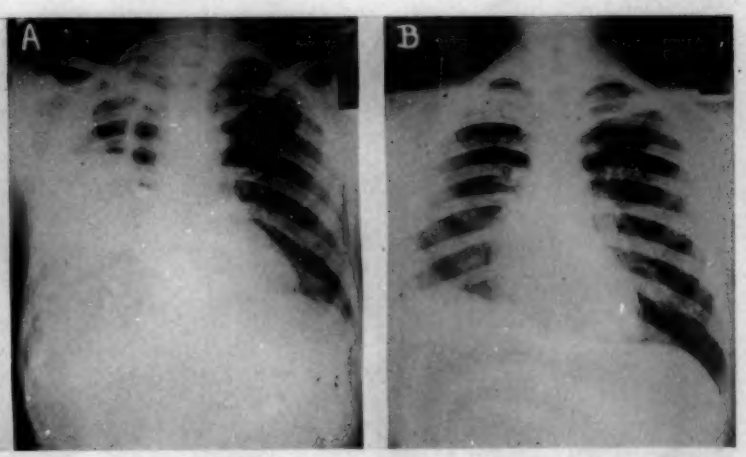

Figure 3. (A) Right-sided loculated hemothorax. Note the thickened pleura and the small areas of loculation above the main large one. A large shell fragment overlies the 8th costovertebral angle; in a lateral view this is shown to be extrathoracic. Blood aspirated from the large pocket cultured gram negative organisms resembling Friedländers bacillus. (B) Appearance of chest two months later after treatment by repeated thoracenteses, intrapleurally placed penicillin, and remedial exercises. At this time fluoroscopy showed good diaphragmatic motion.

may be treated by thoracentesis (needle aspiration of intrapleural contents) or by permitting the air to be spontaneously resorbed. In open pneumothorax, the external wound must be promptly closed by vaselin gauze-pack or by surgery. Tension pneumothorax requires immediate relief by thoracentesis and flutter valve or intercostal water-seal drainage.

B. Hemothorax

(1) Simple Hemothorax

The presence of blood in the intrapleural space is known as hemothorax; as in pneumothorax, a positive intrapleural pressure supplants the normal negative one. In war injuries, hemothoraces generally exist together with a pneumothorax, in varying degrees, and are reported as a hemo-pneumothorax (Fig. 2). By far the majority of hemothoraces are caused by a lacerated lung, due to a penetrating wound, fractured rib, contusion, or blast injury. Bleeding into the pleural space invariably ceases before death ensues because of the low pressure in the pulmonary circulation and because the lacerated lung itself becomes compressed by the accumulating intrapleural fluid and the wound becomes sealed over.

(2) Septic Hemothorax

Initially, hemothoraces are sterile; the antibac-

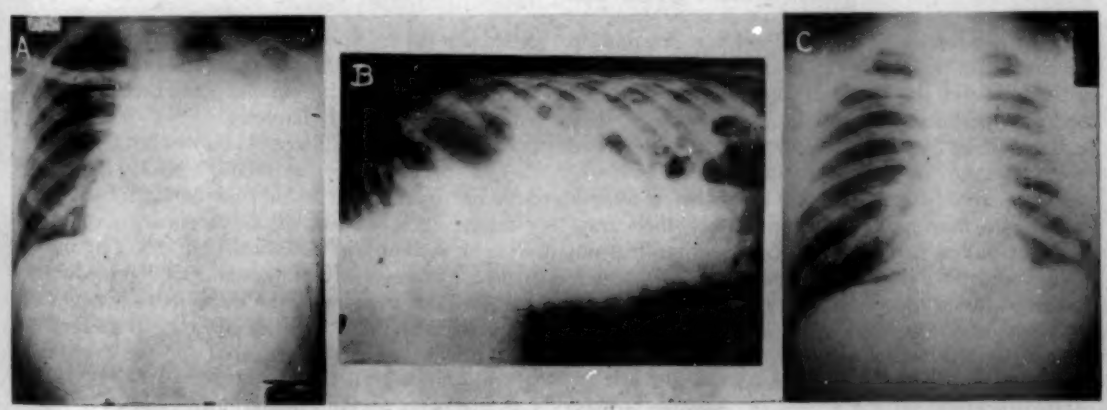

Figure 4. (A) Left-sided extensive hemothorax. (B) Lateral recumbent view. With the patient lying on his right side, multiple fluid levels of a clotted hemothorax are better visualized. (Compare with transverse fluid level of simple hemothorax shown in Figure 2.) (C) Appearance of chest three months later following treatment by thoracenteses and remedial breathing exercises. The small area of left-sided density is shown by fluoroscopy to be thickened pleura. The diaphragm is slightly elevated but is normal in configuration and motion.

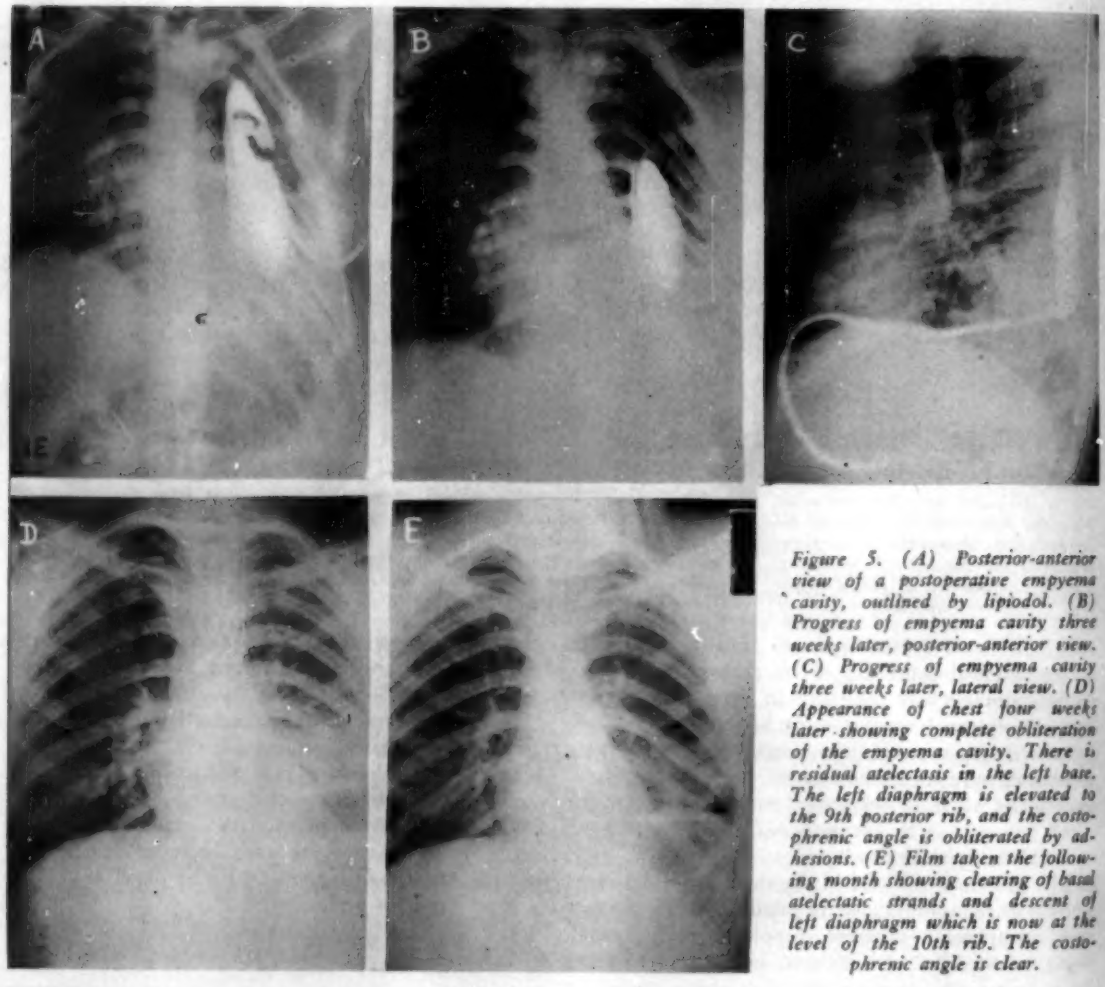

Figure 5. (A) Posterior-anterior view of a postoperative empyema cavity, outlined by lipiodol. (B) Progress of empyema cavity three weeks later, posterior-anterior view. (C) Progress of empyema cavity three weeks later, lateral view. (D) Appearance of chest four weeks later showing complete obliteration of the empyema cavity. There is residual atelectasis in the left base. The left diaphragm is elevated to the 9th posterior rib, and the costophrenic angle is obliterated by adhesions. (E) Film taken the following month showing clearing of basal atelectatic strands and descent of left diaphragm which is now at the level of the 10th rib. The costophrenic angle is clear.

tericidal properties of fresh blood are responsible for this. Unfortunately, the desirable effect is soon dissipated, and the blood becomes, instead, a rich medium for bacterial growth. The organism may be brought in by several routes: a poorly debrided or inadequately cleansed wound, or pieces of clothing or other substances carried in with the offending missile may be responsible (rarely shell fragments or bullets in themselves cause contamination, since the tremendous heat associated with their discharge serves to sterilize the metal); the lowered resistance of damaged pleura easily permits transmission of inspired organisms; and finally, infection may be blood-borne.

Usually early and, if necessary, repeated aspirations of the blood together with chemotherapy successfully combat septic hemothoraces, but due to a greater resultant inflammatory reaction and increased deposit of cellular debris, fibrin and blood cells, one must expect to be confronted with more problems of rehabilitation in this condition than with simple hemothorax; viz., thickened pleurae, adhesions, restricted diaphragm.

(3) Loculated Hemothorax

The homogeneity of hemothoraces frequently becomes interrupted by fibrous bands, resulting in discrete, encapsulated, or loculated areas of blood, with or without air, and fluid (Fig. 3). The fibrous bands, as previously suggested, are formed from the fibrinous deposits of the intrapleurally contained blood or associated pleural effusion. Localized aspirations are generally required for the evacuation of the various pockets.

(4) Clotted Hemothorax (Fig. 4)

Ordinarily blood in the pleural cavity does not clot. The exact reason for this has not been determined. Nor is the reason for clotting understood. The presence of foreign bodies, the churning of the

fluid imparted by respiratory and cardiac motion, the advent of a pleural effusion, extensive tissue damage and the appearance of infection are factors generally thought to initiate the blood clotting mechanism. When extensive, thoracotomy is required for the evacuation of the clotted blood.

C. Empyema or Pyothorax (Fig. 5-A,B,C,D,E)

In battle casualties, empyema generally occurs as a result of a progressive septic hemothorax or as a complication following surgery. As pus is formed and localized in the intrapleural space, the surrounding pleura becomes increasingly thicker and serves to wall off the involved area from the remainder of the hemithorax. While this natural protective mechanism prevents a generalized or total empyema, the thickened pleura, in the convalescing stage, presents a problem of lung reexpansion and cavity obliteration.

Empyema is surgically treated by thoracentesis, closed intercostal drainage, or, when the pus is too thick for evacuation by these methods and localization is complete, open drainage by means of rib resection.

D. Thickened Pleura and Pleural Adhesions

Due to inflammatory reactions and fibrin deposits, thoracic wounds leave their more lasting marks in the form of thickened pleura and pleuritic adhesions. Areas of density may involve any portion of the pleura (Fig. 4-C), and because they impair the transmission of breath sounds and dull the percussion note may have to be differentiated by careful clinical and roentgenological study from pleural effusions. Moreover, by forming a heavily trabeculated encasement over the lung when involving the visceral pleura, full reexpansion or complete expansion of the underlying lung field is restricted. Diaphragmatic motion, by involvement of the diaphragmatic pleura, likewise may be affected.

Thread-like and broad adhesions, in consequence to thoracic injuries, may adjoin the chest wall, the lungs, the diaphragm and the mediastinal structures in any combination. Thus, the diaphragm or lungs may be fixed to the costal cage at any point (Fig. 5-D). Pericardial-diaphragmatic adhesions are not uncommon, while complete localized obliteration of the pleural space is a frequent occurrence; indeed, it represents the slow but effectual modus operandi for the spontaneous healing of empyema cavities.

2. *Pulmonary Pathology*

A. Hemorrhage (Fig. 6)

Bleeding into the air spaces or interstitial tissues of any portion of the lung may occur as a result of laceration by foreign body or rib fragment. Nonpenetrating wounds in the form of direct contusion and blast injuries in which the trauma is represented by waves of compressed air also may result in varying-sized hematomas.

Treatment of intra-alveolar and interstitial hemorrhage is supportive. Resorption is slow as compared to the resolution of a pneumonia.

B. Atelectasis (Airlessness of Pulmonary Tissue)

Localized or massive atelectasis may be secondary to compression by a pneumo-, hemo-, or pyothorax (Figs. 1, 2). It also may result from direct trauma to the bronchiole tree or from the plugging of bronchi by mucus, in which case inspiration of air is blocked while the air initially present in the lung segment involved becomes absorbed. Atelectasis also occurs not infrequently as a complication of surgery in general (Fig. 1).

Conservative treatment consists of breathing exercises and percussion over the involved area in an effort to dislodge a mucous plug if causative; bronchoscopy may be indicated where a mucous plug and the area involved are large and the respiratory distress marked.

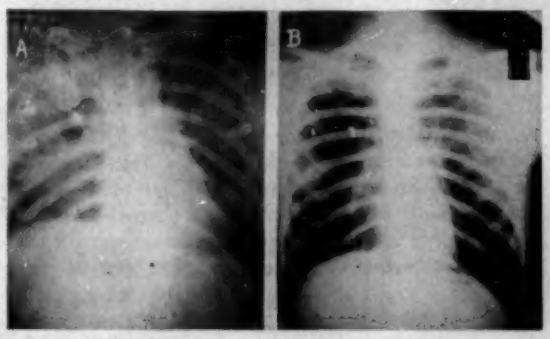

Figure 6. (A) Pulmonary hemorrhage represented by clouding of the right lung field. Note fractured ribs. The shell fragments are shown on lateral views to project extrathoracically. (B) Appearance of chest five weeks later, showing resorption of hemorrhage.

C. Pneumonia and Pulmonary Abscess

Infection may superimpose upon lung tissue devitalized by injury, resulting in a pneumonitis. This, in turn, may progress to the formation of an abscess.

Supportive measures and chemotherapy are indicated in the treatment of traumatic pneumonia. With abscess formation, postural drainage, bronchoscopic drainage or surgery may have to be resorted to. Recently, good results have been reported in some cases with the use of penicillin alone.

D. Interstitial Pulmonary Fibrosis

Healing in the above-enumerated conditions frequently results in the formation of fibrous tissue in the interstices of the lung. As a result the elastic

quality and the functional capacity of the parts involved are diminished. It is important, therefore, to effect maximum lung reexpansion as early as possible to prevent or reduce the extent of interstitial fibrosis.

3. The Diaphragm

Practically every case of penetrating wounds of the chest and those cases of nonpenetrating wounds which nevertheless result in intrathoracic damage reflect injuriously on diaphragmatic motion. Thoraco-abdominal wounds occur in 10 per cent of battle casualties of the chest.[1] This means that in a relatively high percentage of cases the diaphragm is directly traumatized. Moreover, the free fluid of hemothoraces and pleural effusions gravitate to positions overlying the diaphragm and serve not only to irritate and splint the musculature on the involved side but tend to fix it with the formation of adhesions. Obliteration of the costophrenic angles and fixation of the diaphragm at high levels are particularly noted (Fig. 5-D).

Finally, injury to the phrenic nerve may result in temporary or permanent paralysis of the diaphragm supplied. Lacerated or contused wounds may be responsible; in addition, elective crushing of the phrenic nerve following operations involving the diaphragm is an accepted procedure.

4. The Thoracic Cage

Direct injury to the bones, nerves and musculature of the thorax results in dysfunction of the parts involved, and secondarily leads to postural defects. Various degrees of paralysis or disuse atrophy of the pectoral, rhomboid, erecta spinae, trapezius and other muscles are not infrequently encountered. Moreover, postural changes secondary to intrathoracic pathology are commonly met with in battle casualties of the chest. We have observed scoliotic changes setting in as early as the seventh to tenth day following immobilization of a hemithorax by the various pleural and pulmonary conditions previously discussed; the mechanism is one of compensation. Finally, draining thoracic sinuses and fistulae (bronchopleural, biliary, hepatopleural) serves to distort the symmetry of the thoracic cage.

Today more and more emphasis is being placed upon remedial breathing exercises for the rehabilitation of the injured or diseased chest and for the preparation and management of those cases undergoing thoracic surgery for any reason whatever. The blow-bottle is obsolete. It has been replaced by intelligently planned, specific exercises. These are designed to (1) prevent or correct scoliosis and other postural defects; (2) improve the tone of extrathoracic muscles; (3) restore the function of the diaphragm; (4) hasten reexpansion and improve the function of injured and diseased lung fields. By helping to effect early reexpansion of lung fields (Figs. 3, 4, 6), the formation of interstitial fibrosis, thickened pleurae (which in turn restricts lung expansion), adhesions and residual atelectasis are curtailed, and the obliterative process of empyema cavities is markedly facilitated (Fig. 5).

The exercises employed are classified as follows:

1. General Body Exercises

2. Remedial Breathing Exercises

A. Costal Cage

(1) Bilateral

(2) Unilateral (localizing)

B. Diaphragmatic

1. General Body Exercises

General exercises are given twice daily to all patients. After individual indoctrination, these exercises are conducted in two groups, one for ambulatory patients and a separate class for bed patients and those restricted to the wheel chair (generally because of associated leg injuries). All uninjured joints are put through full range of motion in order to obtain optimal musculoskeletal function. The principles of muscle setting and early passive and active motion are applied to immobilized portions of the body. Attention is paid especially to posture and to the development of the upper trunk. It is of the utmost importance in chest cases to seek free movement of the arms, thereby fostering unrestricted motion of the costal cage. Patients are not permitted to exercise to the point of overfatigue. Even though a member of a class, each individual is placed on a plan of graduated exercise suited to his needs.

No definite set of general body exercises can be unequivocally recommended. We are aware that every physical therapist has a particular preference. The important thing is to accomplish a two-fold mission: restore body tone and, by effecting a greater demand on pulmonary ventilation, indirectly exercise the lungs. At this institution the following general body exercises are mainly used: bending, twisting, and rotary movements of the head; forward, upward, backward, and downward movements of shoulders; rotation and adduction of the scapula; abduction, extension, flexion, rotation, and flinging of arms; bending, twisting, and stretching of trunk; abduction, adduction, extension, and flexion of thighs; knee bending; heel raising; general deep breathing exercises.

Individuals who require special exercises for the correction of a scoliosis or other postural defects are sent to the physical therapy clinic where they receive individual attention in addition to and not as a substitute for the regular group exercises conducted on the wards.

2. Remedial Breathing Exercises

Remedial breathing exercises were introduced by the British thoracic surgeon, A. Tudor Edwards, and his physical therapists, the Misses Reed and Linton. The value of these exercises in the treatment of diseased and injured chests has been emphasized not only by Edwards,[2,3] but by other thoracic surgeons as well.[4,5,6,7]

Whether due to direct trauma or secondary to intrathoracic pathology, an immobilized thorax not only effects postural changes but diminishes respiratory excursions. Actually a vicious cycle occurs: limited expansion of the lung reduces costal cage motion which, in turn, reflects on lung expansion. Moreover the ensuing postural changes further encroach on the lung capacity. To offset these deleterious effects, remedial breathing exercises are employed.

The purpose of these exercises is to restore the activity of an incapacitated thorax and diaphragm and, by favoring the use of a particular lung field, improve local blood circulation and accelerate resorptive processes. The exercises employed differ in basic principle from the "blow bottle" and "balloon" methods which until recently have enjoyed such popularity in the treatment of empyema. The effect of these latter methods is not only haphazard but actually imposes emphysemetous changes on the normal lung fields which are better able to accept the challenge of forced breathing.[2]

The rationale of remedial breathing exercises is based primarily on cortical reeducation. Harken,[7] who is largely responsible for popularizing this form of therapy among the U. S. Army personnel, aptly expresses this view as follows: "Normally the voluntary and involuntary breathing mechanism is symmetrical, but when splinted by injury or operation, the involved side is divorced from the respiratory act, the automatic neuromuscular mechanism is interrupted, and the classical deformity of the fused chest ensues. The establishment of voluntary motor control over the affected hemithorax and over the excursions of the diaphragm is the foundation of successful remedial breathing exercises for the remobilization of these structures." In short, accentuation of the voluntary aspects of respiration is utilized to initiate the reeducation and return of function of the entire normal respiratory act. It is essential, therefore, that the same intense concentration be demanded of the patient in the execution of respiratory exercises as is required in the establishment of any new or forgotten act involving neuromuscular coordination. Complete awareness, we believe, constitutes the most important aspect of remedial breathing exercises.

A. Costal Cage Exercises

These exercises are based upon the principle of expansion against external pressure and are carried out by applying manual pressure to areas of the chest where movement is desired.[8] This accomplishes several goals. By expanding against pressure the patient is made conscious of the particular portion of the thorax to be expanded. In addition to mental concentration, a consciousness based on tangible, physical contact is set up—an imposed kinesthesia of the thoracic wall, as it were. Secondly, the patient is made cognizant of the direction of expansion desired, and finally, by requiring the patient to work against resistance, the full value of the principle of active resistive movement is brought into play, further strengthening and mobilizing the thoracic wall musculature and thereby effecting increased mobilization of the ribs.

The application of pressure is administered to the thorax in a definite sequence. The lower costal cage is exercised first, bilaterally, in an effort to seek aeration for the large basal area of the lungs (Figs. 7, 9-A); this is referred to as "lateral basal expansion."[9] Next, an approach is made to the midportion of the thorax, "upper lateral expansion," followed by pectoral (Fig. 9-B) and apical expansion (Fig. 8). Finally, when the condition of the patient especially requires, unilateral posterior basal, posterior midthoracic (Fig. 11), posterior

Figure 7. (A) Bilateral lateral basal expansion. Note position of hands; they are placed well around the lower ribs. Pressure applied by physical therapist for indoctrination of patient. (B) Bilateral lateral basal expansion. Note position of hands; they are placed well around the lower ribs. Pressure applied by patient.

Figure 8. Bilateral apical expansion. The patient is using the middle phalanges of clenched hands for the application of pressure.

Figure 9. (A) Bilateral expansion with belt. Lateral basal. (B) Bilateral expansion with belt. Pectoral.

Figure 10. Unilateral midthoracic lateral expansion of right chest with belt. Note that left hand, controlling pressure to affected side, is uppermost. The unaffected left thorax is steadied by the right hand.

Figure 11. Posterior expansion of right chest with belt. The left hand which is controlling the pressure, is held directly in front of the patient.

Figure 12. Position of hands in diaphragmatic breathing exercises.

scapular, and posterior apical expansion exercises are instituted.

The manner of applying pressure is important. The palm of the hand is used, initially, as the compressive agent (Fig. 7-A), except in upper lobe expansion; in this instance, the fingers or the middle phalanges of a clenched hand are employed (Fig. 8). Pressure must be regulated so that the patient has a definite feeling of a weight to push out against, yet it dare not be so firm that movement is restricted.

During the respiratory cycle, the patient is instructed to breathe in through the nose and expel the air through lips rounded into a very small "O." Later, but only when proficiency in the exercises is obtained, exhalation through the nose is permitted. Expiration is practiced with slow, steady, controlled breathing.

(1) Bilateral Costal Cage Expansion Exercises

In executing bilateral exercises, firm pressure is applied steadily to corresponding parts on both sides of the costal cage until full inspiration is achieved. At this moment, pressure is released in order to permit the thorax to attain maximum expansion. The compressive agent then follows, without effort, the movements of the chest wall during expiration until the end of this phase, at which time pressure is once again exerted and suddenly released. This final application of pressure-and-release serves two purposes: it assists in the complete expulsion of air and, more importantly, imparts to the thorax a "rebound action" that helps initiate and "invigorate" the ensuing inspiratory phase.

Throughout the entire cycle the hand never leaves the chest wall else the sense of continuity of motion might be lost; also, reapplication is likely to impose unsteady, jerky movement to the thorax.

(2) Unilateral (Localizing Costal Cage Expansion Exercises)

These exercises are carried out in the same fashion as bilateral expansion exercises with the exception that steady firmness, instead of resistive pressure, is applied to the unaffected side of the thorax for inhibition of movement. Thus the sound side is held back, both by thought and action, while expansion of the affected area is more decisively promoted (Fig. 10).

Both bilateral and unilateral exercises are practiced from the very first. The former seek to reeducate the entire thorax to function as a single symmetrical unit, while the latter endeavor to bring the expansile capacity of the weak area up to par. Some workers[9] recommend withholding bilateral exercises until the affected area has acquired, by undivided attention, some degree of localized movement. This practice, however, has not worked to advantage in our experience. In fact, the contrary has been true. When localization is not easily obtained, bilateral expansion is employed. The patient is then urged to make his affected side imitate the easily responding unaffected thorax. This procedure finds its physiologic counterpart in the concept that once a pathway to the cortex has been established for a voluntary action of any part of the thorax, it is easier for that knowledge to be transferred to any area where the pattern has been lost and where reeducation proceeds with difficulty.

As soon as feasible, the patient is instructed to employ his own hands for the application of pres-

sure (Figs. 7-B, 8), and hence is not only able to practice the exercises in the absence of the physical therapist, but, by the personal contact, secures the added advantage of realizing a more intimate neuromuscular association. Finally, when the patient's condition permits, a belt supplants the palm of the hand as the compressive agent (Figs. 9, 10, 11). This allows for greater relaxation of the shoulders and markedly facilitates posterior expansion exercises. The belt should be about two inches in width and long enough to permit approximately eight inches overlapping across the anterior midline when placed around the thorax; the hands, therefore, control the pressure to their contralateral sides (Fig. 10).

In using the belt, the following technical points should be observed: (1) that portion of the belt encircling the affected side should be held uppermost, or the pressure engendered will be spent in an oblique direction rather than be confined to the desired area; (2) the belt must be clasped with palms down, since supination results in a cramped position of the shoulders; (3) for posterior localization, the pressure-controlling hand must be held directly out in front of the chest. This eliminates contact of the belt to the anterior and lateral aspects of the thorax (Fig. 11).

B. Diaphragmatic Exercises

Since the respiratory act largely depends upon the diaphragm, it is important that every effort be made to impart full range of motion to a splinted or damaged musculature; a two to three-inch excursion, adjudged by fluoroscopy, should be sought. Diaphragmatic exercises are carried out in the following manner:

Patients are required to place their hands on the abdominal wall in order to "feel" the working of the diaphragm as it reflects on the movements of the abdominal wall. No pressure is applied. The hands are placed lightly over the front of the lower ribs so that the finger tips are nearly touching just below the sternum (Fig. 12). It will then be seen that on inspiration the fingers will be pushed out by the rising of the abdominal wall which gives way to the increased intra-abdominal pressure imposed by the descent of the diaphragm. Conversely, on expiration, with ascent of the diaphragm and diminution of intra-abdominal pressure, the abdominal wall will fall away from the fingers.

The inspiratory phase is executed with relaxed upper abdominal muscles; the upper chest is quiet and the lower abdominal muscles are held in. At the height of inspiration the breath is sustained. Just enough air is then exhaled to permit the forcible inspiration of more air. As the forced inspiration is made, the palpating fingers feel the distention of the underlying abdominal muscles. This discernment of distention is ultimately utilized to promote vigorous diaphragmatic motion. The patient is repeatedly urged to "fill out" the upper abdomen or to "enlarge the dome" against his fingers. With this exhortation, forced inspirations are repeated four to six times before initiating the expiratory phase. Thus the palpating fingers not only serve, indirectly, as a gauge for the diaphragmatic motion but act as an intermediary in the reestablishment of a neuromuscular pattern.

Expiration is moderately slow and controlled; it is accompanied by a pulling-in of the upper abdominal muscles, while the lower abdominal muscles maintain the same tone as in inspiration.

Localized diaphragmatic exercises are effected by directing the "distention effort" particularly to one of the palpating hands.

Before commencing remedial breathing exercises, it is important for the physician and physical therapist to establish a rapport with the patient. The nature of the pathology and the importance of these exercises are explained, together with the rationale and mechanism of the exercises. The intelligent cooperation of the patient will be found to be in direct proportion to his complete understanding of the problem.

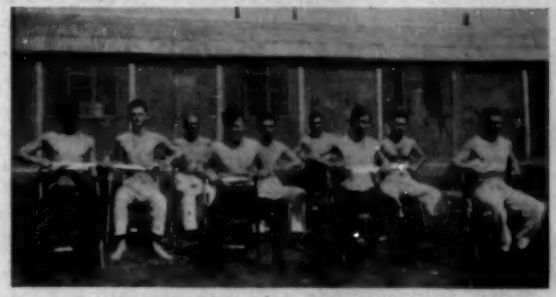

Figure 13. Group remedial breathing exercises.

Remedial breathing and general body exercises are instituted as soon as the patient is admitted to the hospital unless his condition prohibits. Individual attention is the rule. When the patient is well-versed in the detailed requirements and purpose of each exercise, he is allowed to join group exercises (Fig. 13). To insure the continuance of personal supervision, no more than six to nine patients are permitted to each group which, in turn, is exercised twice daily by the physical therapist. At the same time individual effort is not only encouraged but regulated. Very stubborn cases are required to exercise hourly by the clock under the surveillance of trained personnel. It is interesting to note that patients find they are soon able vol-

untarily to expand localized areas of the thorax at will, without the assistance of a compressive agent. In fact we believe it advisable to exhibit this accomplishment in a veteran patient and set it up as a goal for new ones. The novelty lends a sense of achievement and humor to what might ordinarily be considered drab exercise.

Early ambulation, which fosters lung reexpansion, is sought in every instance possible. Above all, from the very beginning our patients are made conscious of their postures, whether they are ambulatory or confined to bed. Indeed, not only are the patients made posture conscious of themselves but they are urged to watch for and point out violations in others. Good posture is made the keyword of the ward.

Clinical progress is correlated with x-ray and fluoroscopic check-ups. Flouroscopy clinics are held weekly; diaphragmatic motion, costal cage motion, illumination of the lung fields, the nature and extent of adhesions and pleural thickening, reexpansion of the lung, et cetera, are carefully noted. Each case is discussed and the exercises reevaluated accordingly.

The thoracic rehabilitation program outlined in this article has been applied to approximately one hundred and fifty cases of chest injuries presenting various kinds and degrees of pathology. Our results have been uniformly gratifying. The average case approaches normal within four to six weeks. Empyema cases often require eight to sixteen weeks of intensive exercising. In many instances a diaphragm initially fixed at the eighth or ninth posterior rib has resumed not only its normal position, but restricting adhesions have yielded to the force of persistent exercises and the normal contour and mobility of the diaphragm have been regained (Fig. 5-D, E). Marked scolioses, secondary to hemithorax immobilization have been corrected in every instance, while the function and tone of extrathoracic muscles have been restored.

SUMMARY AND CONCLUSIONS

Remedial breathing exercises aim to reestablish disrupted neuromuscular patterns by cortical reeducation. They are based upon the principle of expansion against external pressure. Bilateral costal cage, localized costal cage and diaphragmatic exercises are utilized and are augmented by general body exercises.

Remedial breathing exercises are not purported to substitute for medical and surgical treatment of thoracic pathology; they are not meant to replace thoracotomy, thoracentesis, incision, drainage and such. Rather they are designed to supplement the effect of these procedures and to rehabilitate the injured thorax. As a preoperative measure they increase the vital capacity and establish a pattern for postoperative restorative exercises. By promoting reexpansion of the lung, and preventing residual fibrotic changes, by guarding against or overcoming postural defects, and by improving the action of the muscles concerned with respiration, these exercises assume an important role in the achievement of maximum respiratory function in diseased or injured chests. And it is function that one is primarily interested in, for while an observer may not see an immobilized thorax, an incapacitated lung or a crippled diaphragm, the patient is none the less handicapped.

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The Importance of Stabilization

Charles LeRoy Lowman, M.D.

The human body, even if normal, is always in a state of unstable equilibrium when it is in the standing position. The superincumbent mass is continuously forced over and down by gravitational pull. Standing in a stride position, a person is unstable in the sagittal plane; if standing with one foot in line with the other, with a similar wide stance, he is unsteady in the lateral plane. To offset this unsteadiness, or "keep balance," lest he fall over, many muscles must be actuated to apply a constant counter-rotatory force at various joints. These muscles must all act against their opponents to control the joint movements which they stabilize. If muscle weakness or imbalance from a paralytic involvement is superimposed, the work load of the muscles is greatly increased and progress towards deformity, especially in the active growth period, is hastened.

It is a well known law in mechanics that the base of action must be stabilized so that the action of parts working from it may develop maximum force. To illustrate: if a derrick whose normal load is one ton is overloaded by a two ton load it will tip over even though the mast, the boom and the rope take the stress. The stability of the foundation must be sufficient for the load.

When, as in poliomyelitis, malalignment or postural deviation of the part or body segment exists, stabilizing muscles act at a disadvantage because of asymmetrical stress. For instance, with a pronated foot which lists into valgus, the peroneals are adaptively shortened while the posterior tibial lengthens. In opposing the weight column the former cannot maintain easy balance without stress. In such a condition the leg lists into inward rotation with added stress on the femuro-pelvic muscles. If there also is a forward tilt of the pelvis with lordosis and/or a lateral tilt from a short leg, an asymmetry in the trunk muscle action adds further stress.

In the muscle training of poliomyelitic patients it is important to recognize the relationship of opponent muscles in their intrinsic action. Still more important is the recognition of the more remote action of the muscles acting to maintain fixation of the base of action from which the intrinsic muscles act.

During medical school days we learned our anatomy in the dissecting room. We noted the origins and insertions of the muscles, the geography of their blood and nerve supply—largely as basis for later study of regional and surgical anatomy for operating table use. Usually insufficient attention was given to dynamic anatomy or analysis of biomechanical factors involved in motor performance. Our physical therapists often are somewhat ahead of us in this respect, due to their prolonged study of kinesiology and their familiarity with the variations of both normal and abnormal motor action. Both the surgeon and the therapist, however, are prone to give limited consideration to an involved part, from the standpoints of deformity, disability or performance.

For the best ultimate result in the reconstruction and rehabilitation of the "polio" patient, a thorough head to foot examination—lying, sitting and standing—should be made by the surgeon. Only in this way are tendencies towards positional deviations of the various parts noted, as well as motor imbalances that influence maintenance of equilibrium and the performance of various acts.

The surgeon's examination should be supplemented by the physical therapist's muscle check to record strength relationships and to check the character of performance of movements. The physical therapist's check is a valuable guide in the care and management of a case, and helps the surgeon in planning the various reconstruction procedures. However, such a record of performance must be intelligently made by the therapist and wisely interpreted by the surgeon. Otherwise it can fail to tell the whole story or actually can be incorrect if it shows performance in terms of intrinsic muscle action only, without taking into consideration function of the extrinsic fixators.

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Presented at the Clinical Conference on Poliomyelitis, Warm Springs, Georgia, September 15-17, 1947.

Let me illustrate with the case of a six year old boy I was asked to examine in Detroit in 1939. This boy's arms and shoulders were so involved that when he tried to raise his arms, even with assistance, he could only hunch up his shoulders. His chart showed "trace" for the deltoid on one side, and "poor plus" for the other. I firmly held down his shoulder girdle to the mattress and told him to push his elbows away from his sides. This he was able to do. I then recommended to the surgeon in charge an interscapular fascial transplant, as I considered the boy's poor performance due to paralysis of the rhomboids and lower trapezius. In a day or so I performed this operation at the surgeon's request. Six months later word was received that the boy could put one hand on his head and hold the other arm straight up.

This case illustrates the need for a fixation of the base. Until this was provided the weight load of the arm dragged the shoulder girdle forward and downward so that the origin of the deltoid moved towards its insertion in such a way that the muscle could get no purchase. To make matters worse the command to raise the arm stimulated the levator scapulae and the upper trapezeii. This pointed the shoulder and made for greater mechanical disadvantage for the deltoids.

The failure to recognize the importance of these trunk stabilizers often leads to long-continued, repetitious intrinsic exercising. Valuable time may be lost by the patient; his costs for hospitalization and physical therapy are increased because of slow progress or poor results. A more extensive and careful analysis frequently shows that the involved basic fixators are actually the muscles which should receive priority in training.

This was brought to my attention years ago in the case of the fourth patient in the abdominal fascial transplant series first reported by me in Toronto in 1932. The upper rectus abdominis and upper obliques were involved and the child could not properly use her legs. About three months after I did a fascial transplant from costal margins to upper end of lower rectus, I asked the mother what, if any, change she noticed since operation. Her answer was, "Why, Doctor, she can now raise her left leg."

The preoperative muscle chart showed left hip flexors rated a "fair minus," (a 3 on our old scale of 9). Consequently, she was thought to have a rather severe psoas involvement. Actually, the effort at raising the leg dragged down the pelvis because it was not stabilized on the thorax. The poor performance was not from a weak hip flexor but rather from a paralyzed segment in the abdominal fixators.

The importance of these abdominal muscles in maintaining lower trunk stability is shown by a comment made by Cureton[1] in his article on the flutter kick in swimming. He states that beginners practicing this maneuver tire quickly at first because of strain on the abdominal and pelvic muscles. Again he says that 70 per cent of the drive from this stroke comes from the upper leg and pelvis.

Another point of special importance to the orthopedic surgeon is that deformity often occurs so insidiously that spinal and femuro-pelvic distortions are well on their way before they are discovered. The cause is the unbalanced, continuous effort to move a body segment to some position of fixation to accomplish a desired act. A common illustration is that in the absence of quadratus lumborum and obliques, the patient, even with a fairly good complement of muscles in the leg itself, must lean far over to one side in the attempt to lift the leg and swing it forward to take a step. When such an imbalance exists unilaterally, spinal curvature is almost sure to develop.

Physical therapists who give their major attention to retraining leg muscles sometimes forget that the base of action in pelvis and trunk should not be held in an asymmetrical position. To illustrate, while watching a physical therapist give a pool treatment, I saw the patient placed in a side-lying position on a plinth, holding to the upper edge of the plinth with the upper hand. The physical therapist stood facing the patient's feet and gave studious attention to ankle and foot movements. The patient, to keep from sliding down on the plinth and to maintain the side-lying position, actuated the holding muscles of the upper trunk while the spine was in a position of scoliosis, and also attempted to maintain pelvic stability in this position during the intrinsic action of the foot muscles. Here, the more powerful trunk muscles were exerted strongly to make up for the weaker muscles. This tended to produce a trunk deviation or fix any that might already exist. I observed also that the exposed shoulder showed deltoid atrophy. Hence, in holding the position, the pectorals, serratus, teres and latissimus all were put into continuous action which actually more than neutralized any intrinsic training of the weak deltoid.

Often a patient with trunk and leg involvement is required to sit for considerable periods of time. Even though such a patient is supported by brace or corset, automatic stimulation of trunk muscles occurs whenever head and arms are moved. Hence, aside from the gravittal load on the spine, the trunk stabilizers, if imbalanced as by partial paralysis of abdominals, may constantly exert a deforming influence.

An important physiological function of trunk stabilization is its relation to cardio-respiratory function. Years ago Goldthwaite pointed out the importance of diaphragmatic action and the fact that deviations of trunk posture interfere with the diaphragm's proper action and decrease its efficiency as a pump. To be at its best functionally, then, the dorsal spine and rib cage must be stabilized and maintained in an optimum position.

The muscles of the abdominal wall aid stabilization and act to resist the thrust of the diaphragm. They store up the elastic tension which aids expiration and affords the compression essential to this pump's efficient action of forcing venous and fluid content out of the abdominal cavity. Consequently, a paresis or paralysis of lower trunk muscles causes this compressive, stabilizing factor of these fixators to be weakened or lost. Venous stasis occurs, adding tax on the heart to make up the deficiency in oxidizing the toxic products. Therefore, when a patient with severe involvement of the legs and lower trunk attempts to walk he places on himself a double strain: (1) poor stabilization of pelvis on thorax makes him work at a mechanical disadvantage; (2) his active muscles which are under such extreme effort demand proportionately more blood, and the deficiency in function of the venous return mechanism makes for a physiological overload.

In previous papers attention has been called to the value of the abdominal fascial transplant operation in ameliorating this condition. To illustrate here how much the diaphragm depends on abdominal stabilization: Recently a boy was examined who had severely involved abdominal muscles but who wanted to be a musician. He had attempted both trumpet and clarinet without being able to blow a note. After his abdominal wall was repaired he was able to begin successful training.

Another indication of defective stabilization is seen in the common gluteus medius limp, in which the gluteus medius, the major lateral stabilizer of the pelvis on the leg, is defective. The muscle is placed at a double disadvantage because it cannot act effectively in its normal way. In consequence, the patient lists the body over to the affected side and raises the opposite side of the pelvis with the quadratus lumborum and external oblique. This tips down the ilium of the affected side so that origin and insertion of the gluteus approach each other, and action is still further embarrassed. With some success, I have attempted to correct this condition by running up a strip of fascia from the trochanter and fastening it to a section of the external oblique which is lifted from its insertion on the crest of the ilium. This transmits some of its force as a stabilizer directly to the trochanter and thus aids the weakened gluteus.

Similarly, when the pelvis tips down in front because of weak abdominals, the rectus femoris cannot function properly. Considering the pelvis as a transverse bar or block, the action of leg muscles transmitted to it tends to pull it down away from the thorax, lengthening the distance in front and producing a lordosis behind. Correction or control of the lordosis by corset or brace, plus special exercises to shorten and tighten the abdominals greatly improves the intrinsic performance of the rectus, sartorius and tensor fascia femoris by holding up the front of the pelvis. If paralysis of the abdominal wall exists, its repair by fascial implants is necessary to obtain a more efficient action of the quadriceps mechanism.

In conclusion, let me say that in the early convalescent phase of the treatment of a poliomyelitic, careful analysis of both intrinsic and extrinsic factors should be made. Their status relates directly to performance and also to general body mechanics as expressed in posture, balance and gait. Proper consideration of these factors will improve motor function. Fatigue will be lessened, physiological function will be enhanced, and insidious deforming influences will be checked.

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Coming Meetings

Date	*Organization*	*Place*
Aug. 23-27	American Occupational Therapy Association	Book-Cadillac Hotel, Detroit, Mich.
Sept. 6-10	American Congress of Physical Medicine	Netherland Plaza Hotel, Cincinnati, Ohio
Nov. 7-9	National Society for Crippled Children and Adults	Commodore Hotel, New York, N. Y.

The Measurement of Joint Motion*

Part II – The Technic of Goniometry

Margaret Lee Moore, M.S., R.P.T.

(*Editor's Note:* This is the second of a series of three papers. Part I appeared in the May 1949 issue of the REVIEW, and the third paper of this series will appear in a later issue.)

The preliminary planning for the experimental study of the reliability of goniometry led to an exhaustive review of the literature. As has been described in Part I of this series, "Introductory Review of the Literature," many varied technics have been advocated. Few have included an evaluation of the rationale of the described procedure. Many were sketchy. Others were incomplete as only a few joint motions were discussed. A critical analysis of the technics described in the published literature led to the formulation of a set of *a priori* principles of goniometry. They were subsequently utilized as the basis of a technic of goniometry, defensible as to its rationale, which was mastered by the physical therapist (the author) responsible for the collection of the data designed to test the reliability of this clinical tool. A description of the standard procedure and its theoretical basis follows.

INSTRUMENTATION

The simple double armed goniometer (Fig. 1) is perhaps the most desirable for general clinical use. It is universally applicable to all joints. It can be used on all types of patients, whether they be bed patients or ambulatory, whether they can execute voluntary movements or suffer from paralysis. The placement is less dependent on the patient's ability to assume a specified starting position than many of the highly specialized devices described in the literature.

The half circle protractor should be large enough for easy reading. It should be accurately marked to at least one degree. As illustrated in Figure 1, there should be a clearly marked extension of the base line of the protractor throughout the length of the stationary arm. There should be a clearly marked line extending from the pivot of the protractor and the moving arm to the distal tip of this arm. Both this and the previously described line will greatly aid the accurate placement of the instrument.

If possible there should be an extension of the moving arm in the direction opposite its major length. This short extension would project to the periphery of the protractor when the moving arm is directed in an arc opposite from the protractor. This situation arises in measuring pronation and supination and makes for more accurate reading of the protractor scale. If the instrument is not made of transparent plastic there should be a "key hole" type of indicator cut in the moving arm on the level of the protractor scale. This assures direct and accurate reading of the numerical scale. An accurately placed and fairly tight pivot is required for the junction of the moving arm with the center of the base line of the protractor. The arms of the instrument should be twelve to sixteen inches long. This permits better sighting when applied to anatomical parts characterized by long lever arms.

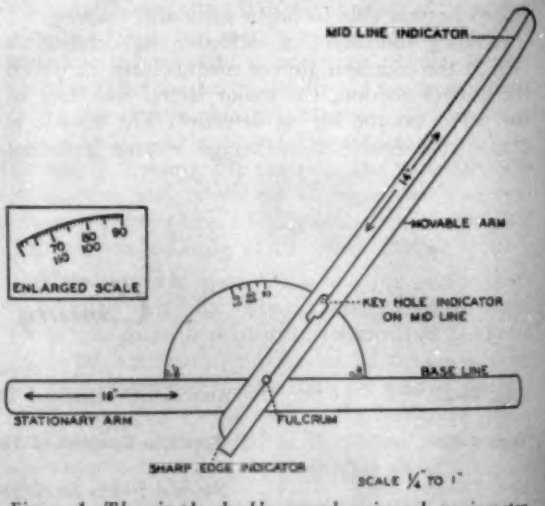

Figure 1. The simple double armed universal goniometer.

*This work was done in the Division of Clinical Research, Baruch Center of Physical Medicine, Medical College of Virginia, in partial fulfillment for the M. S. in Physical Therapy. The author is now affiliated with the Department of Physical Medicine, University of Colorado Medical Center, 4200 East 9th Avenue, Denver, Colorado.

If the instrument is made with two stationary arms instead of the usual one, it can be used on the right and left sides of the body without loss of precision in placement or accuracy of reading. Construction from transparent plastic also aids in accurate placement but instruments of this type may be brittle and easily broken. The flexibility of plastic enables the operator to manipulate the device more readily when applied to anatomical parts irregular in contour. A fairly satisfactory compromise is to construct the goniometer of aluminum of appropriate weight upon which may be mounted a good quality draftsman's protractor.

The choice of a full circle or a half circle protractor for the instrument usually is one of personal preference. The advantage of a half circle type lies in the ease with which it can be used for a patient in the prone or supine position. A device with a full circle protractor is difficult to adjust to the hip, shoulder, or elbow due to the mat or table top which may interfere with accurate placement. The accuracy of the instrument's construction, partially guaranteed by use of a standard draftsman's protractor of commercial design, cannot be stressed too strongly. A reliable operator is rendered unreliable by utilization of a poorly constructed tool.

Methods of Recording Range of Joint Motion

Data obtained by measuring the movement occurring about joints should be recorded in a manner which will permit quick and accurate interpretation. Three methods are in general use. One is to record the figures obtained in tabular form. Another is to graph progress in range of motion from one observation to the next. The third, and perhaps the most desirable, is to record the measurements on diagrams of specific joints. Superimposed on this is the numerical protractor scale. This method makes clear at a glance the end points of motion as well as the system of numerical grading adopted. Since both numerical expression and nomenclature vary in different clinics and hospitals, this self-explanatory method will be clearly understood by all.

Nomenclature

Standard nomenclature for the terminology used in designating directions of motion is recommended. This system of notation is the universally understood anatomical position and the terminology presented in *Morris' Human Anatomy*[1] and in the *BNA* (Basel Nomina Anatomic) listings.[2]

There has been considerable confusion introduced by the usage of nonstandard terms. For example, palmar flexion and hyperextension appear frequently in the clinical literature. They were probably intended to clarify descriptions. However, they do little but add inconsistency and misinterpretation.

Numerical Expression of Joint Motion

Measurements in each arc of motion should begin at 0° and progress toward 180°. Joints in the anatomical position are at 0° of motion. As joint motion occurs the amount of movement is positively recorded in degrees. For example, as initial disability in flexion at the knee joint improves under treatment, the numerical data recording progress are figures which grow proportionately larger.

When the anatomical position cannot be attained the degree of disability is recorded by a lack of motion equal to its magnitude. As this restriction is decreased the numerical expression of the deformity gets smaller. This situation is most often met in the knee and elbow joints where a lack of extension frequently is encountered following disease or trauma.

The only exception to the rule is the numerical expression of the magnitude of pronation and supination. For convenience, the midposition of the two motions is selected as the starting point. Motion increases from 0° to 90°, and often more, in both directions from this starting position. This method will easily take care of those individuals who can supinate or pronate more than 90°.

The system of numerical notation proposed gives small figures, increasing logically as mobility improves and decreasing logically as deviations from the anatomical position lessen. This is an advantage over systems which are based on the full circle of 360° or on a half circle arc which begins at 180° in the starting position and decreases to 0° as motion increases. In these, not only are the figures often quite large, but it is difficult to place them logically in a movement pattern when they begin at points other than zero degrees of motion.

Neutral Position and Starting Position

An understanding of the anatomical position is important in the orientation of the operator to the problems of joint measuring. In addition, so-called specific preferred starting positions are necessary in most instances. These positions vary from the erect anatomical position. They are necessary in order to obtain the most isolated arc of motion attainable in a single movement phase. By adhering to these positions substituted motion or compensatory movements are most easily recognized and ruled out. By standardizing these preferred starting positions as much as the individual patient's condition allows, much interoperator variation in measurements can be eliminated. Much of the unreliability of goniometric measurements is attrib-

utable to varied and nonspecific starting positions in daily clinical use.

Axis of Motion

Much has been written about the "axis of the joint,"[3,4,5] the "center of the joint"[6,7] and the "center of rotation"[8,9] in relation to goniometric measurements. Clark,[10] Robinson,[11] Wiechec and Krusen,[4] Rosen,[12] West,[7] Conwell,[13] Ashhurst[3] and Molander[14] specify that the pivot of the protractor of the measuring device be centered on an anatomical landmark presumed to be such an axis. Surely no one specific bony landmark can be truthfully called an axis of motion for complex movements of the shoulder, ankle and wrist joints, to cite perhaps the most complex. Inman's[15,16] work on the complicated motions of the shoulder and the several joints combined in its action is strong evidence in support of this conclusion.

The axis of motion appears to shift as normal motion progresses. How then can the acromion process at the shoulder, the ulnar styloid at the wrist and the lateral malleolus at the ankle be specified as such a key axis location? This has been suggested in the literature.[7] Consideration of the mechanics of movement indicates that the intersection of the longitudinal projections of the two limbs or sides of the angle must coincide with the axis of motion. The acromion process, the ulnar styloid and the lateral malleolus, to name a few such examples, are not in this intersection position throughout the full range of motion. To attempt to fix the pivot of the goniometer to any such specific anatomical landmark is open to criticism and may falsify the motion actually present in the joint. It may then be impossible to adjust the arms of the instrument parallel to the limbs of the anatomical angle. This should be the primary consideration in instrument placement. If the moving arm of the instrument is carefully placed as nearly as possible parallel to the long axis of the moving limb of the joint, and the stationary arm is placed parallel to the long axis of the apparently fixed part of the joint, then the axis of motion will fall where the two intersect and will automatically localize in its approximately correct position. Meticulous preliminary inspection of the relation of the fixed to the moving segment prior to placement of the goniometer is an important aid to improved localization of the true axis of motion.

Placement of the Goniometer

Instructions for placement of the measuring tool should be specific in order to avoid indecision and to minimize variation in the technic of different operators. The following technic is thus outlined for each motion of each joint of the extremities to be measured. With each is included the preferred starting position which is applicable to most patients. Included also are precautions, suggestions for accurately locating bony landmarks, as well as hints for recognizing commonly occurring substituted motions which may greatly influence the measurements taken.

Norms for Comparison

Table I presents the range of motion possible in joints as compiled by Daniels, Williams and Worth-

Table I

*Norms of Joint Range of Motion**

JOINT	MOVEMENT DIRECTION	NORMAL RANGE LISTED IN DEGREES
Shoulder	Flexion	0—90
	Extension	0—50
	Abduction	0—90
	Medial Rotation	0—90
	Lateral Rotation	0—90
Elbow	Flexion	0—145 to 160
	Extension	145—160 to 0
Radio-ulnar	Supination	0—90
	Pronation	0—90
Wrist	Flexion	0—90
	Extension	0—90
	Abduction	0—25
	Adduction	0—55 to 65
Metacarpo-phalangeal	Flexion	0—90
	Extension	0—20 to 30
Finger	Interphalangeal, Proximal, Flexion	0—120
	Interphalangeal, Distal, Flexion	0—80
Thumb	Metacarpophalangeal	
	Flexion	0—60 to 70
	Extension	60—70 to 0
	Interphalangeal	
	Flexion	0—90
	Extension	90—0
Hip	Flexion	0—115 to 125
	Extension	0— 10 to 15
	Abduction	0— 45
	Medial Rotation	0— 45
	Lateral Rotation	0— 45
Knee	Flexion	0—120 to 130
	Extension	120—130 to 0
Ankle	Flexion	Not listed
	Extension	0—40 to 45
Toes	Metatarsophalangeal	
	Flexion	0—25 to 35
	Extension	0—80
	Interphalangeal	0—50 to 90

*Adapted from Daniels, Williams & Worthingham (1946)[17]

ingham in their *Muscle Testing: Technics of Manual Examination*.[17] These ranges are included in the instruction manual which follows. Because, in clinical practice, shoulder joint flexion and abduction are continued to the limit of movement, norms of these two ranges are listed as 180° in the Standard Procedure. Daniels et al. consider only the degree of movement attributable to the deltoid.

The norms published by McBride[18] deviate little from those of Daniels, Williams and Worthingham. He gives 25° less wrist extension, 30° more hip extension, and 5° to 10° more knee flexion than did Daniels et al. The range of wrist abduction and adduction and hip joint rotation was equal for the two sources but varied as to the location of that movement in the arc of motion. Other norms of joint range motion are available. Each presents some variations with those mentioned above. However, the differences, in general, are insignificant.

BASIC ELEMENTS OF TECHNIC

1. Begin by placing the patient in good body alignment. This should simulate the anatomical position as closely as possible. Examine this position critically and prevent as much deviation from the initial alignment as possible during the execution of the movement to be measured. Such deviation or substitution of motion may falsify results significantly.
2. Before starting to measure tell the patient simply and clearly what to do. If necessary, demonstrate the movement and urge the patient to execute as pure an anatomical motion as possible with no substitution or compensatory movements.
3. For ease in measuring and to isolate best the desired motion, the joints are measured from specific starting positions rather than in the true erect anatomical position. These will be referred to as "preferred positions."
4. All movements of extremities should be measured in degrees and from specified starting or 0° positions. Measurements in each arc of motion begin at 0° and progress toward 180°.
5. The zero starting position for any single movement of a joint is identical with the anatomical zero position except for the radioulnar joints where the midposition is selected as zero.
6. Having aligned the body, instruct the patient to swing the moving part rhythmically through the arc of motion to be measured and localize the approximate axis of rotation by inspection. If this cannot be done volitionally, move the part passively.
7. As a general rule, always apply the goniometer to the lateral side of a joint. Exception: supination. There are a few other exceptions which will be explained below.
8. The protractor is so placed that when the indicating arm is at zero it points to the anatomical zero position which is usually distal. There are a few exceptions to this which will be discussed in the technic manual which follows.
9. In placing the stationary arm of the instrument parallel with the longitudinal axis of the fixed reference part, attempt to sight over a considerable distance and not just on a limited area. To be careful of this will insure more accurate measuring.
10. To have both extremities execute the same movement simultaneously often aids balance, coordination and the maintenance of body position.
11. Since the true axis of motion is located at the intersection of the two limbs of the angle, this cannot be determined until the end of the desired movement. If the arms of the instrument are fixed carefully at the end of the desired movement, the nail head pivot of the instrument must fall in the region of the true axis of motion.
12. When the limb moves anteriorly to produce flexion the protractor is directed anteriorly in the anter-posterior vertical orientation plane. Conversely, when the limb moves posteriorly to produce flexion or extension the protractor is inverted and directed posteriorly in the anter-posterior plane. Or, the protractor is always placed in the direction of the movement to be measured. Exception: pronation and supination.
13. The instrument should be held loosely, away from or in light contact with the patient's body. By trying to maintain the position of the goniometer against the moving part, the instrument position may be in error and the patient may be prohibited from executing his full range of motion.
14. Much depends on the steadiness of the operator in maintaining the position of the measuring instrument. If possible, the operator should steady her holding arm against her side or on a table top, depending on the position in which she has placed the patient.
15. Execute no force on the body in placing the instrument. To do so would destroy the accuracy of placement. Example: A slight pressure on the volar surface of the wrist might give 5° to 10° above true supination.
16. By finding the maximum degree of motion in both directions, the range of motion can be calculated. Example: Flexion plus extension

equals range of motion; pronation plus supination equals range of motion.

17. The elbow and knee are considered to be 0° extension joints since motion progresses normally in only one direction from the anatomical position. The range of motion is found by subtracting the lack of extension of the joint from the flexion degree obtained. Example: Flexion 100°, extension —20°, equals range of motion 80°.
18. In all joints which move in two directions from zero position, the maximum motion in both directions is added to obtain the full range of motion. Example: Shoulder, wrist, radio-ulnar; flexion and extension equals range of motion. In an abnormal joint in which a return to the zero anatomical position is not possible, the two figures are subtracted, as in 17.

STANDARD PROCEDURE

I. *Shoulder Joint*

A. Flexion: 0° toward 180° anteriorly. The hand should travel forward with the palm of the hand facing the ceiling. Measure from the lateral aspect of the body.
   1. Preferred position—
      a. The patient should be supine with good postural alignment.
      b. The patient may be standing or sitting in a good posture if it is not desirable to have support from the firmness of the table top.
   2. Stationary arm—Place along the midaxillary line of the trunk in line with the greater trochanter of the femur with no increase in lordosis permitted.
   3. Moving arm—Place along the lateral midline of the humerus in line with the lateral condyle of the humerus. (This will be out of line in full normal shoulder flexion since the humerus must rotate in order to assume this position beyond approximately 150° to 165°; use the olecranon process beyond this point.)
   4. The axis will be somewhere in the vicinity of the acromion process but *do not sacrifice accurate placement of the arms of the goniometer* to secure the hinge of the instrument at this position.
   5. Caution: Avoid extension of the trunk and abduction of the shoulder. Keep the moving arm close to the body. Avoid elevation of the shoulder.

B. Extension: 0° posteriorly toward 50°. Keep subject's hand facing forward.
   1. Preferred position
      a. The patient should be prone with good postural alignment.
      b. As in I-A, 1-b.
   2. Use the same reference points as in I-A but reverse protractor.
   3. Caution: Avoid forward flexion of the trunk and abduction of the shoulder.
   4. Remarks: Extension can be measured with a straight elbow or with a flexed elbow to rule out action of the biceps, but always re-measure the same way.

C. Abduction: 0° toward 180° laterally. Measure from the posterior aspect of the body.
   1. Preferred position
      a. The patient should be standing or sitting with his back to the operator. The thumb should lead in the direction of the movement, with the palm of the hand facing forward.
      b. The patient may be prone but in good alignment.
   2. Stationary arm—Place parallel to the spine but at the lateral aspect of the body; that is, in the posterior axillary line. The protractor is directed laterally away from the body.
   3. Moving arm—Place on the posterior aspect of the arm parallel to the posterior midline of the humerus toward olecranon process.
   4. The axis will fall somewhere in the vicinity of the acromion process. Do not set goniometer by this.
   5. Caution: Avoid lateral flexion of the trunk, flexion or extension of the shoulder joint and elevation of the shoulder girdle.

D. Adduction. This is the return from abduction. Use the same technic as in I-C.

E. Medial rotation: 0° toward 90°.
   1. Preferred position—The patient should be supine. Abduct the arm as close to 90° as possible with the elbow bent to 90° and with the palm of the hand facing the body. The forearm is perpendicular to the table top. The full length of the humerus should be resting on the table top. Allow only the elbow over the edge of the table.
   2. Stationary arm—Place parallel to the floor with the nail head of the instrument at the olecranon process. Maintain this parallel zero position during movement of the part. The protractor is directed superiorly toward the ceiling.
   3. Moving arm—At the completion of the executed motion set along the dorsal mid-

line of the forearm between the styloid processes.

F. Lateral rotation: 0° toward 90°.
1. Preferred position—Use the same as in I-E.
2. Placement—Use the same as in I-E.
3. Caution: Watch for decrease or increase in abduction of the shoulder. The operator may steady the patient by placing a finger under the elbow (to keep a reference joint of motion). This in no way hinders movement but it will rule out much substituted motion. Avoid flexion, extension or elevation of the shoulder.
4. Remarks:
   a. If this measurement is taken from a supine position, as is recommended, the humerus must be elevated with a pad to the plane of the acromion process.
   b. If possible, note the degree of motion in both directions at the same time, as it is difficult to maintain the position of the patient and the instrument. This can be done by setting the stationary arm parallel to the long line of the trunk.

II. *Elbow Joint.*

A. Flexion: 0° toward 145° to 160°. The palm of the hand is forward in the anatomical position.
1. Preferred position—The patient should be supine or standing with the arm parallel to the lateral midline of the body and in the anatomical position.
2. Stationary arm—Place along the lateral midline of the humerus toward the acromion process of the scapula with the protractor facing anteriorly.
3. Moving arm—Place along the lateral midline of the radius toward the styloid process.
4. The axis will fall somewhere in the vicinity of the lateral condyle of the humerus. Set the instrument arms first and do not sacrifice their positions to secure this one.

B. Extension: This is the return from flexion and the same technic is used as in II-A.

III. *Radio-ulnar Joints*

A. Pronation: 0° toward 90°.
1. Preferred position—Measure in a sitting or a standing position. The elbow is flexed to 90° and the arm is held close to the side of the body. The thumb is directed superiorly. There should be no support under the forearm.
2. Stationary arm—Place the instrument on the dorsal surface of the wrist parallel to the long axis of the humerus with the protractor directed away from the body.
3. Moving arm—At the end of the executed motion place along the dorsum of the wrist on a level between the styloid processes of the radius and the ulna. Attempt to place the moving arm along the area of the styloid processes which is fairly flat and free from muscle or soft tissue.
4. Caution: Keep the elbow close to the side and do not allow abduction or any rotation of the shoulder. Keep the instrument proximal to the carpal region at the distal end of the radius and ulna. Avoid lateral flexion of the body toward the opposite side.
5. Remarks:
   a. It is difficult to maintain the position of the stationary arm. There is no specific bony landmark on the wrist and the contour may change with edema or bandages.
   b. To take a reading from the protractor the moving arm must be traced across the protractor with a card or ruler edge and the degree for a corresponding angle then taken. (Some instruments have an extended pointer on the moving arm which accomplishes this purpose.)

B. Supination: 0° toward 90°.
1. Preferred position—The same position is used as in III-A-1.
2. The technic is essentially the same as in pronation but the instrument is placed on the volar surface of the wrist with the protractor directed medially across the body at the end of the executed motion. Moving arm is adjusted to the widest, most flattened area just proximal to the wrist. Avoid lateral flexion of the body to the same side as the extremity being measured.

IV. *Wrist Joint*

A. Flexion: 0° toward 90°.
1. Preferred position—The patient may be sitting or standing but should have no support under the length of the forearm. The elbow should be flexed. The forearm should be in pronation. The protractor is directed inferiorly.
2. Stationary arm—Place along the lateral midline of the ulna toward the olecranon process.
3. Moving arm—This line parallels the mid-

line of the 5th metacarpal.

4. The pivot of the instrument will fall in the carpal region of the wrist after the arms of the instrument have been adjusted.
5. Caution: Palpate the area of the hypothenar eminence in order to set the instrument arm along the long line of the 5th metacarpal.
6. Remarks: Flexion can be measured on the radial side of the hand but the measurements of the two sides of the wrist will vary due to the anatomical structure of the wrist and the cupping of the hand on the little finger side. If measured on the radial side use the 2nd metacarpal for the distal landmark.

B. Extension: 0° toward 70°. The protractor should be facing superiorly. The same placement is used as in IV-A, but the axis will shift. Place the arms of the goniometer correctly and the appropriate position of the axis will be in a line perpendicular to the nail head pivot of the instrument.

C. Abduction or radial flexion: 0° toward 25°. The instrument is on the dorsum of the wrist with the protractor directed toward the thumb side.

1. Preferred position—Abduct the arm to approximately 90° with the elbow flexed. The forearm should be in midposition of pronation and supination. The forearm may rest on a table top but there should be no support under the hand.
2. Stationary arm—Place along the midline of the dorsum of the forearm between the radius and the ulna toward the lateral condyle of the humerus. Palpate to locate osseous reference points referred to. It is easier to place the instrument if the part is in 0° of pronation and supination with the arm abducted from the shoulder.
3. Moving arm—Place along the 3rd metacarpal toward the center of the metacarpophalangeal joint of the 2nd finger.
4. Caution: Avoid flexion or extension of the wrist or pronation and supination of the forearm. Do not use the phalanx for a point of reference due to movement of the metacarpophalangeal joint itself.

D. Adduction or ulnar flexion: 0° toward 55° to 65°. The same placement is used as in IV-C, but the protractor is directed toward the ulnar side.

V. *Metacarpophalangeal Joints*

A. Flexion: 0° toward 90°.

1. Stationary arm—Place along the lateral aspect of the metacarpal for the 1st and 5th joints. (The 3rd and 4th cannot be measured with a large universal goniometer.) The protractor is directed toward the palm of the hand on the lateral aspect of the joint.
2. Moving arm—Place along the lateral aspect of the proximal phalanx of the respective joints.

B. Extension: 0° toward 20° to 30°. The protractor is directed toward the dorsum of the hand. The same placement is used as in V-A.

VI. *Interphalangeal Joints*

0° toward 80° to 120°. If measured on the lateral border, use the lateral midline of the phalanges which make up the joint.

Remarks: In regard to the measurement of motion occurring in the metacarpophalangeal and interphalangeal joints, a drawing or tracing will suffice in many instances. There is a small finger instrument well described by Hurt[19] which fits the dorsum of the joint. This instrument can be used on all fingers and all joints thereof. If it is used, be sure its edges parallel the contour of the part for as long a distance as possible.

VII. *Hip Joint*

A. Flexion: 0° toward 115° to 125°. Measure from the lateral aspect of the hip with the protractor directed anteriorly.

1. Preferred position—
   a. The patient should be supine and in good alignment.
   b. Measuring from a side lying position with the involved side uppermost is often a good check on observations made in the preferred position.
2. Stationary arm—Place parallel to a line from the greater trochanter of the femur to the crest of the ilium. This would parallel the long axis of the trunk.
3. Moving arm—Place along the lateral midline of the femur toward the lateral condyle.
4. The axis will fall in the region of the greater trochanter.
5. Caution: The musculature of the hip and thigh makes this measurement difficult. Palpate the part to be sure of placement.
6. Remarks: The long axis of the trunk toward the midaxillary region can be used as long as the back is not allowed to flatten. Allow the knee to bend if the question of tight hamstrings is not a problem

[illegible] dealt with. If measurements are taken with a bent knee once they should be repeated thus.

B. Extension: 0° toward 10° to 15°. The patient should be in a prone position and the protractor is directed toward the posterior aspect of the body. The same landmarks and the same precautions should be used as in flexion, except that an arched back and an elevated hip will be posture problems to be controlled. It is often wise to measure from the side lying position.

C. Abduction: 0° toward 45°. Measure from the anterior aspect of the pelvis.
   1. Preferred position—The patient should be supine and in good alignment.
   2. [illegible]tionary arm—Place on a line between [illegible]r superior iliac spines. Maintain this.
   3. Mov[illegible]n—The instrument is adjusted on the anterior surface of the thigh so that it parallels the dorsal midline of the femur toward the midline of the patella. In adjusting this maintain the parallel position of the stationary arm; however, it may need to be shifted on the line in order for the moving arm to be adjusted to the midline of the femur.

D. Adduction: 0° toward 10° to 15°. The same landmarks and placements are used as in VII-C. The uninvolved leg will have to be moved in abduction to allow for adduction of the involved leg.
   1. Caution: The pelvis will drop but this need not destroy the placement of the instrument or accurate measurement. The body may curl in the direction of motion and the hip may tend to rotate laterally for abduction and medially for adduction. Avoid this.

E. Medial rotation: 0° toward 45°. Measure from the anterior position.
   1. Preferred position—
      a. The patient should be sitting on a bed or table with the knee flexed to 90° over the edge of the support provided. Support the thigh over its full length. Sit erect and check the hip and leg line as follows: the anterior superior spine of the ilium, to the midline of the patella, the midline of the dorsum of the ankle, and the interspace between the 2nd and 3rd toes should be in the same sagittal plane.
      b. A[illegible]ly the same position can be used with the patient supine and the knee flexed over the edge of the table.
   2. Stationary arm—From a starting position of 0° adjust the stationary arm parallel to the midline of the tibia with the nail head approximately in the midpatella region. Maintain the instrument position approximately perpendicular to the floor, even though the leg will move from that position as in shoulder rotation. The protractor is directed laterally.
   3. Moving arm—Place along the crest of the tibia to a point midway between the malleoli (anteriorly).

F. Lateral rotation: 0° toward 45°.
   1. Preferred position — The protractor is changed to face medially and the same landmarks are used as in VII-E.
   2. Caution: Avoid hip flexion, extension, abduction or adduction alone or in combinations of movement.
   3. Remarks: Both arcs can be measured with a single instrument placement if the stationary arm is adjusted parallel to the table top and the moving arm follows the crest of the tibia. However, most instruments cannot be read directly in order to secure the resultant value since the starting or anatomical position at 0° may be 90° on the protractor.

VIII. *Knee Joint*

A. Flexion: 0° for complete extension to 120° to 130° of flexion.
   1. Preferred position—
      a. The patient should be sitting on a treatment table with the thigh supported and the knee flexed over the edge of the support.
      b. An alternate position is to place the patient prone with toes extending over the edge of the table when the knee is extended.
   2. Stationary arm—Place parallel to the lateral midline of the femur on a line from the lateral condyle to the greater trochanter.
   3. Moving arm—Place parallel to the lateral midline of the fibula toward the lateral malleolus.
   4. The nail head or axis will fall in the region of the lateral condyle of the femur.
   5. Caution: Do not attempt to keep the instrument close against parts of the lower extremity during motion. The contour changes to such an extent as to make this practice inadvisable. Palpate the thigh and leg before the procedure is begun in order

to best avoid muscle bulk in the placement of the arms of the instrument.

B. Extension: This is the return from flexion and the same technic and placement are used as in VIII-A.

IX. *Ankle Joint*

A. Flexion and extension: Normal range—In the anatomical position, the position of the foot is like that in erect standing. At 0° the foot forms a right angle with the leg. Extension to 45°, flexion to 20°. Use the lateral aspect of the joint with the protractor facing anteriorly.

1. Preferred position—Have the patient sit on the table with his knee flexed over the edge or have the patient lie down with his knee flexed.
2. Stationary arm—Place parallel to the lateral midline of the fibula on a line from the head of the fibula to the lateral malleolus.
3. Moving arm—Place parallel to the lateral midline of the 5th metatarsal. Palpate to be sure of the position.
4. The axis will shift considerably for the two positions of motion but shift the instrument superiorly or inferiorly until the two arms of the instrument parallel the reference landmarks given and do not attempt to set the nail head at any specific point.
5. Caution: Avoid as much inversion and eversion as possible.
6. Remarks:
   a. Measurements made on the medial aspect of the ankle will vary from those made on the lateral aspect of the ankle, mostly due to the longitudinal arch of the foot. Once a procedure is used, always repeat measurements with the same technic.
   b. Ankle movements may be measured with the knee straight, but with the knee bent restrictions in motion due to a tight gastrocnemius are ruled out to a great extent. Again, always duplicate your first procedure.

B. Inversion and Eversion (of the Transverse Tarsal Joint): 0° toward 90° in both directions from the anatomical zero position. This is not the normal range of motion. Check the foot and leg line to be sure the patient is in a good starting position.

1. Preferred position—No specific position is recommended, except that the knees should be flexed to rule out hip rotation as this will introduce errors into the measurements.
2. Stationary arm—Place arm on the plantar aspect of the foot from the center of the heel to a line between the 2nd and 3rd toes with the nail head at the heel. The protractor is directed toward the toes. The instrument should be maintained in this position after motion is begun.
3. Caution: Avoid rotation of the hip and flexion and extension of the ankle. Do not attempt to hold the instrument tightly against the part.
4. Remarks: Only grossly quantitative measurements can be taken of this motion due to the difficulty in ruling out partial flexion and extension.

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A Message to Physical Therapists

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Medicine with its allied professions is a world-wide profession, following everywhere the same methods, actuated by the same ambitions and pursuing the same ends. A new method of clinical approach is broadcast to the professions within a short time. The united efforts of countless workers in many lands have won for us the great victories of science. Linked together in the strong bonds of community interests, the professions form a world unit of progressive evolution.

We are welcoming these graduates into a remarkable group of men and women who have dedicated themselves to the care of the crippled, the maimed and the ill. Over the past years these men and women have fostered unity through their national organizations and have found that community interests, together with the active cooperation of many persons of different abilities, have lessened misunderstanding and ill will and have fostered progress, set up educational requirements and worked toward a unified profession.

Unity in professional groups is essential. Here you can use democratic methods and solve internal disputes. You will be part of these organizations and will in turn become teachers of future students.

The course you have begun is not completed here. You have not just finished a college course, or a medical course, you have begun a life course, for which the work of a few years under teachers is but preparation. You can all become good physical therapists, a few of you will become great therapists. One of you may do easily and well what others cannot do at all or very badly, which is an excellent definition of a genius. It goes without saying that no man can be a good teacher who is not at the same time a good student.

We must all be students of men if we are to be able to serve men. We must study their habits, character, mode of life, their behavior under varied conditions, their vices, virtues and peculiarities. Begin with a careful observation of your fellow workers and your teachers, then every patient you see is a lesson in much more than the malady from which he suffers.

As students you have sought for the truth, and as graduate therapists you may be dismayed at the conflicting notions of truth. It is a very simple matter. Each of you begins with a desire to get as much truth as possible. Osler said that no human being is constituted to know the truth, the whole truth and nothing but the truth; and even the best of men must be content with fragments, with partial glimpses. Unless from the start the limitations of your minds and emotions are frankly accepted, nothing but disappointment awaits you.

The truth is the best you can get with your best endeavor—the best that the best men accept—with this you must learn to be satisfied, retaining at the same time an earnest desire for a larger portion. Charles Lamb said that some people do not know what to do with truth when it is offered to them. However, the tragedy is to finally reach a condition of mind-blindness in which the truth is not recognized. Harvey knew his contemporaries well, and for twelve successive years demonstrated the circulation of the blood before daring to publish the facts on which the truth was based. It is one of the great tragedies of life that every truth has to struggle to acceptance against honest but mind-blind students. True humility and steady purpose alone enable the student to shift position to meet new conditions in which new truths are born or old ones modified beyond recognition. The truth is changing under our very eyes, and physical therapists are fortunate to be part of one of the most rapidly expanding fields of medicine.

Scientific advances are noteworthy, but the honest heart is still the most important part of a therapist's armamentarium. The honest head is apt to be cold

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and stern, given to judgment, not mercy, and not always able to entertain true charity which, while it thinketh no evil, is anxious to put the best possible interpretation upon the motives of a fellow worker. An honest heart has no part of uncharitableness—the most prevalent of modern sins. Often it creeps upon us as a thoughtless evil, sort of a tic or trick, an unconscious habit of mind and tongue that gradually takes possession of us. In the chronic offender "with every word a reputation dies"; or it may be faint praise that damns.

You have many doubts and anxieties. Will you be able to meet the requirements of your professional work? Will you fulfill the promise you have shown as students? William Osler advised his students to take no thought for the morrow—let each day's work absorb your entire energies, satisfy your widest ambition. The man who is worrying about his future, anxious over examinations, doubting his fitness for the profession is certain not to do so well as the man who cares for the matter in hand.

Essentially your training has served not to make you physiologists or anatomists but has taught you to recognize and to treat physical ailments, has taught you to become practical therapists. Knowledge which you can use is the only real knowledge, the only knowledge which has life and growth in it and converts itself into practical power. Professional maturity means personal maturity with emotional balance and intellectual fulfillment.

Ours is the field which has been too long neglected—the treating of the old and infirm with the physical and yet time-honored agents of heat, motion and radiations together with the newer modalities embodied in electricity, electromyography, muscle reeducation and the complex training known as rehabilitation.

No longer must the spastic be pronounced hopeless. No longer is the crippled child abandoned to a life of misery and frustration. Physical medicine and physical therapy have banded together with the specialities of orthopedics and medicine to bring the injured, the maimed, the chronically ill and the paralyzed to new levels of functional usefulness.

The physical therapist is in a unique position. In this profession alone the old art of the laying on of hands persists—it had been too long forgotten. Relaxation—physical, mental, and emotional—is excellent therapy, and the therapist works with, rather than for, the physician in attaining the best for the patient, restoring hitherto lost units of humanity to new levels of usefulness and personal fulfillment.

There are three personal ideals I recommend to you.

The first is to do the day's work well and not bother about tomorrow. It has been said that this is not a satisfactory ideal. It is. You must have the power of settling down to a day's work and trying to do it to the best of your ability. Let the future take care of itself.

The second ideal is tolerance toward your professional colleagues and toward the patients committed to your care.

The third is to cultivate humility and to remember that each patient carries within himself the seeds of his recovery.

Each of you will make the practice of physical therapy very much what you choose. To one it will be a worry, a care, a perpetual annoyance. To another it will be a daily joy and a life of as much happiness and usefulness as possible. Humility will be yours—consciousness of weakness while seeking strength and truth. Confidence—knowing power, yet recognizing the limitations of your art. Pride—in the profession of which you are now a part.

The Salpêtrière.—The greatest neurologist of all time, Charcot's name will always be associated with his old hospital in Paris, the Salpêtrière. The hospital got its queer name from the fact that it once served as an arsenal and thus became a center for the storage of saltpeter, the essential ingredient of gunpowder. Sometime in the 17th Century it was converted into an asylum for old women and later, after Pinel's time, into a hospital for the mentally disturbed, epileptics and patients with a wide variety of nervous diseases. To this hospital in 1848 came the young Charcot as a medical student, the son of a professional carriage builder who had considerable artistic talent, an inheritance that became well marked in his famous son. . . . After four years of internship at the Salpêtrière, Charcot practiced medicine for a few years before returning in 1862 to his old hospital as one of the chiefs of medical service. . . . His crowning achievement in neuropathology was his studies in cerebral localization. . . . His name is remembered in the artery of Charcot, Charcot's disease, amyotrophic lateral sclerosis and the changes in the joints in tabes dorsalis. . . . He was, indeed, the founder of modern neurology and his studies in cerebral localization led directly to the development of neurosurgery.—*Henry R. Viets, The History of Neurology in the Last One Hundred Years, Bulletin of the New York Academy of Medicine, December 1948. From J.A.M.A., 139:16:1078, April 16, 1949.*

SCHOOLS APPROVED FOR TRAINING PHYSICAL THERAPISTS

By Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director	Technical Director	Entrance Requirements*	Length in Months	Classes Start	Tuition	Certificate, Degree, Diploma
CALIFORNIA							
Children's Hospital, Los Angeles	Samuel S. Mathews	Sarah S. Rogers	a-b-d	14	Sept	$300	Cert. or Degree
College of Medical Evangelists, Los Angeles[1]	F. B. Moor	R. Wm. Berdan	a-b-c-d	12	Sept	$225	Cert. or Degree
University of Southern California, Los Angeles	Charles L. Lowman	Charlotte W. Anderson	a-b-d[2]	12	Sept	$496	Cert. or Degree
University of California Medical School, San Francisco[1]	Lucile M. Eising	Margery Wagner	d-e	12	Sept	$220[4]	Cert. or Degree
Stanford University, Stanford[1] (Palo Alto)	Wm. Northway	Lucille Daniels	a-b-d[3]	12	Jan June	$523.30	Cert. or Degree
COLORADO							
University of Colorado Medical Center, Denver	Harold Dinken	Mary Lawrence,	a-b-d	12	Sept	$300	Cert. or Degree
ILLINOIS							
Northwestern University Medical School, Chicago	John S. Coulter	Gertrude Beard	a-b-d	12	Oct	$450	Cert.
IOWA							
University of Iowa Medical School, Iowa City	W. D. Paul	Olive C. Farr	e	12	Sept	$200	Cert.
KANSAS							
University of Kansas School of Medicine, Kansas City	Donald L. Rose	Lilyan G. Wagner & Ruth Monteith	a-b-c[3]	12	Feb Sept	$80[4]	Cert. or Degree
MASSACHUSETTS							
Bouve-Boston School of Physical Education, Boston	Howard Moore	Constance K. Greene	H.S.	36	Sept	$500 yr.	Degree
Simmons College, Boston	Wm. T. Green / Arthur L. Watkins	Janet B. Merrill	a-b-d	16-36	Sept	$550	Cert. or Degree
Boston University College of Physical Education for Women: Sargent College, Cambridge 38	Kenneth Christophe	Adelaide McGarrett	H.S.	36	Sept	$435 yr.	Cert. or Degree
MINNESOTA							
University of Minnesota, Minneapolis[1]	Miland E. Knapp	Ruby M. Green	H.S.	36	Oct	$530[4]	Degree
Mayo Clinic, Rochester	Earl C. Elkins	Helen Belknap	a-b-c	12	Sept	None	Cert.
MISSOURI							
Washington University School of Medicine, Barnes Hospital, St. Louis[1]	Sedgwick Mead	Beatrice F. Schulz	c	2 yrs	Sept	$400 yr.[5]	Degree
St. Louis University School of Nursing, St. Louis[1]	Alexander J. Kotkis	Sr. Mary Imelda	H.S.	36	Jan Sept	$300	Degree
NEW YORK							
Albany Hospital, Albany	John W. Ghormley	Catherine Graham	a-b-d	12	Sept	$250	Cert.
Columbia University, New York City[1]	Wm. B. Snow	Fley Pinkerton	a-b-c	1 or 2 yrs	Sept	$450 yr.	Cert. or Degree
New York University School of Education, New York City[1]	George G. Deaver	Elizabeth C. Addoms	a-b-d	12	Sept	$589	Cert or Degree
NORTH CAROLINA							
Duke University School of Medicine, Durham[1]	Lenox Baker	Helen Kaiser	a-b-d	15	Oct	$300	Cert.
PENNSYLVANIA							
D. T. Watson School of Physical Therapy, Leetsdale[1]	Jessie Wright	Kathryn Kelley	a-b-d	12	Oct	$300	Diploma
Graduate Hospital, University of Pennsylvania, Philadelphia[1]	George M. Piersol	Dorothy Baethke	a-b-e	12	Sept	$300	Cert.
TEXAS							
Hermann Hospital School of Physical Therapy, Houston	Oscar O. Selke, Jr.	Mary Elizabeth Kolb	a-b-d	12	Oct	$300	Cert. or Degree
University of Texas School of Medicine, Galveston	G. W. N. Eggers	Ruby Decker	a-b-d	12	Jan	$163[4]	Cert.
VIRGINIA							
Baruch Center of Physical Medicine of the Medical College of Virginia, Richmond[1]	Walter J. Lee	Susanne Hirt	a-b-c[3]	12	Sept	$351[4]	Cert. or Degree
WISCONSIN							
University of Wisconsin Medical School, Madison[1]	Harry D. Bouman	Margaret Kohli	a-b-c[3]	12	Sept	$120[4]	Cert. or Degree

*Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Baccalaureate degree; H.S. = High School graduation.

[1]Male students are admitted.

[2]High school graduates accepted for a four-year course leading to A.B. degree.

[3]High school graduates accepted for four-year college course.

[4]Nonresidents charged additional fee.

[5]Certificate granted by Children's Hospital Society; degree granted by University of California at Los Angeles.

[6]Tuition reduced second semester of second year.

Editorials

Physical therapists have an obligation, both to themselves and to their patients, to maintain good health. The physical work required in administering the various types of treatment uses a great deal of energy and contributes to fatigue. Dealing with large numbers and all types of patients each day requires endless patience and is a factor in nervous fatigue. In order to keep happy and content it is essential that the physical therapist's capacity for work be equal to the requirements of his job.

Responsibility for the care of patients rests to some degree upon the physical therapist. This responsibility requires that he be in proper working condition, punctual and regular at work. When an indiscretion causes the physical therapist to be unfit for his work, responsibility toward the patient has been neglected. The patient suffers if the physical therapist is irritable. The irritability may be due to fatigue and it matters not whether the fatigue is the result of play or work. Inefficiency as the result of fatigue and overwork is the concern of the physical therapist.

Physical therapists are above the average in health, as a rule. They have had good training and their occupation offers the opportunity to follow a healthful program. From a physical standpoint the occupation is favorable; it supplies a variation in type of work, and adequate exercise which usually is controlled within normal limits. There is a certain amount of responsibility but it is not grave enough to cause worry. The work brings satisfaction through service to others. Dealing with different types of people and various problems keeps the work interesting and stimulating. All of these factors contribute to good physical and mental health.

Since the happiness of the physical therapist and the quality of his work is dependent upon physical well-being, it is important that he start with good health. It is the duty of the school which selects and trains students to see that they are equipped physically to do their work. It has been my experience that each class has a high percentage of students who need some corrective measures and that there is always a small percentage who need major corrections. Routinely, we find that many have poor posture.

The relationship of poor posture to decompensation is made clear and the students are taught to take better care of themselves by means of periodic rest and a specific program of exercise. In the scoliosis cases, correction is carried out as well as treatment for the functional decompensation. Since one of the exercises for poor posture is proper gait, corrective shoes frequently are used. An even greater number of students have disabilities and deformities of the feet and these are corrected by use of corrective shoes and correct gait. Disorders of the feet are so common that treatment of the feet is practically a routine procedure for all our students.

Assuming that the physical therapist begins his career with good health, there are several factors which are essential to its maintenance. If ill, he should seek good medical advice and follow it conscientiously. Self-medication and experimentation should be avoided.

Adequate rest is a necessity; the amount of sleep required varies with age and the individual. The best method for conservation of energy is periodic rest during the day—at noon, in the middle of the forenoon and in the middle of the afternoon. The periods of rest should be brief since prolonged rest has a tendency to decrease muscle strength. Adequate exercise usually is obtained in the course of work and offers no problem.

The pursuit of an avocation is important. The happiness of everyone is dependent somewhat on the use of his inherent aptitudes. The more they are developed, the richer will living be. The failure to develop an aptitude often leads to a feeling of frustration. The answer lies in becoming interested in other pursuits besides one's work—music, art, photography, writing or any other hobby. Recreation in the form of regular vacations away from work is essential.

It is to the advantage of the physical therapists as individuals and as a group, and to the people for whom they work, to keep themselves fit not only to make the work more enjoyable but also to live happier lives within themselves.

—Emil D. W. Hauser, M.D.

Conference Speakers

Shirley M. Cogland, A.B.

Assistant Technical Director of Physical Therapy, Children's Hospital, Boston, Massachusetts; Special Instructor in Physical Therapy, Simmons College, Boston.

Miss Cogland is a graduate of Syracuse University and Physical Therapy Course No. 445, Harvard Medical School, Courses for Graduates. After completing the course at Harvard Medical School and before accepting her present position, she served as Physical Therapist, Children's Hospital and Harvard Infantile Paralysis Commission, Boston; as Physical Therapist (U. S. Naval Reserve) in various Naval hospitals including Norfolk, Va., Sampson, N. Y., and an orthopedic convalescent hospital, Springfield, Mass., and as Assistant Technical Director, School of Physical Therapy, Children's Hospital, Los Angeles.

A. Teresa Fallon, R.N.

Consultant in Orthopedic Nursing for the National League of Nursing Education on the staff of the Joint Orthopedic Nursing Advisory Service.

Miss Fallon received her R. N. degree from Lowell General Hospital, Lowell, Mass., and her B.S. from Boston University School of Nursing, Boston. She did staff nursing and private duty at Lowell General Hospital, has served as staff nurse and head nurse at Massachusetts General Hospital, and as Clinical Instructor in Orthopedic Nursing at Children's Hospital in Boston.

Miss Fallon is a member of the American Nurses Association and the National League of Nursing Education.

Alfred O. Ludwig, M.D.

Private Practice, Medicine and Psychiatry, Boston, Massachusetts.

Doctor Ludwig graduated from Harvard Medical School, interned at Massachusetts General Hospital, and took postgraduate education in Internal Medicine at the University of Leipzig, Germany. He then served as Assistant Resident and Resident in Medicine at Massachusetts General Hospital, and Resident Physician in Psychiatry at McLean Hospital, Waverly, Mass. He has been in private practice of Medicine and Psychiatry since 1937, and was associated with Dr. Walter Bauer and his group in the study of chronic joint disease from 1937-42. In 1942 he was called to active service as a Captain in the Medical Corps, served in the European Theater, and was promoted to a Major, Medical Corps, in 1944. He has been a member of the Boston Psychoanalytic Institute since 1941.

Thomas Gucker III, M.D.

Assistant Orthopedic Surgeon, Children's Hospital, Boston; Assistant in Orthopedics, Harvard Medical School; Member of Staff, Massachusetts Infantile Paralysis Clinics of the Children's Hospital (successor to the Harvard Infantile Paralysis Commission).

Doctor Gucker served as a Resident in Orthopedic Surgery, University of Pennsylvania Hospital; Assistant Instructor in Orthopedic Surgery, University of Pennsylvania School of Medicine; Chief Resident in Orthopedic Surgery, Children's Hospital, Boston, and as Fellow in Orthopedic Surgery, National Research Council, 1946 to 1948.

Association Activities

Chapter Membership

According to the bylaws adopted May 1948 all active members are automatically chapter members. Where the bylaws state that chapter membership may be in the state where the physical therapist resides or works, this means that if his present residence is in an adjoining state to that in which he works (living in Arlington, Virginia, and working in Washington, D. C.) the member is entitled to choose membership in either chapter. In no case is this to be interpreted that the physical therapist may elect membership in the chapter of his permanent residence if he is working in a distant state. Many members in returning dues payments did not indicate a chapter membership. Others have indicated a chapter far removed from place of residence or work. The National Office, therefore, is placed

in the position of indicating to the member the proper chapter affiliation (according to our records here), notifying the chapter and transmitting dues to that chapter.

Other members have indicated that they are on temporary assignments and do not know where they expect to be employed permanently. In these instances, chapter membership is assigned to the present place of employment with a note that transfer of chapter membership may be made as soon as the member accepts employment in another chapter area.

In order to keep all records in order, the member should notify the National Office of any change of employment and address in order that proper transfer of chapter membership may be made. The National Office, upon receipt of notice, will notify both old and new chapter of the change.

It is expected in this first year of change that there will be questions and sometimes errors in chapter assignment. If all will cooperate in notifying the National Office promptly of address changes with a note indicating new chapter affiliation, it will be of great assistance. A copy of the letter or postcard also should be sent to the secretary of the chapter in which the member currently holds membership. A smooth, efficient plan for maintaining proper chapter affiliation is dependent upon the cooperation of the individual member.

Polio Recruitment

The American Physical Therapy Association has taken over the recruitment of physical therapists to work temporarily with infantile paralysis patients in epidemic areas. Since we are anxious to maintain the same efficient service in supplying physical therapists that the National Foundation for Infantile Paralysis has carried on in the past, those interested and available should write: Polio Recruitment Service, American Physical Therapy Association, 1790 Broadway, New York 19, N. Y.

Let us know NOW if you will be available for temporary work in infantile paralysis epidemic areas.

Membership News

Personals

• March 20th and 21st were dates of two happy reunion parties for Mary McMillan and her students and associates of former years at Reed College, Portland, Oregon. Of the scores of women students of physical therapy who met with her on the campus in the days of 1918-19, the following were present at the tea given Sunday afternoon at the home of Dr. and Mrs. Charles Manlove: Mabel Parker, Ella Roberts, Miriam Ewing, Eva L. Applegate, Gladys Cook, Mary Shannon Snook, Helen Manlove, Cora Howes, Ruth Babb, and Muriel Jean Robertson. On the evening of March 21st at the home of Dr. and Mrs. Elmer C. Carlson, Dr. and Mrs. Arthur C. Jones and some of the younger members of the Oregon Chapter joined with the former students in greeting Miss McMillan. Doctor Carlson was Anatomy Instructor at Reed in 1918 and will be remembered by all the Reed College physical therapists who were in training at that time. For the occasion, Doctor Carlson's daughters played charming duets on the piano and pipe organ. Miss McMillan then told of her experiences in giving service to the first casualties of World War II and later enduring the hardships of prison camps and ships en route from China and the Philippines back to the United States. Eastern members remember greeting Miss McMillan in 1944 after her return on the exchange ship "Gripsholm." We of the far West felt cheated not to be there at the time. Beloved by her students and associates during her long and distinguished career, Miss McMillan was more than welcomed in Portland. Her coming was a "victorious return."

• The Milwaukee Downer College invited Elizabeth Jones to give two lectures to their senior students of occupational therapy. One lecture was given on physical therapy procedures and was illustrated with slides.

• Florence Anderson, Sumter, S. C., is with the National Foundation for Infantile Paralysis at the Convalescent Unit of Charlotte Memorial.

• Gillian Griffith is now employed at Bergen County Hospital, Bergen Pines, Ridgewood, N. J.

• Ann Hodges is now a member of the staff at Duke Hospital, Durham, N. C.

• Edith Vail is at Duke on a loan from Greensboro to help out especially with the polio during the absence of Mary Clyde Singleton.

• Owen W. Tester is now working at the Brooklyn Regional Office of the Veterans Administration pending opening of the Brooklyn Veterans Hospital.

• Alice L. Baker is now at the Veterans Hospital, Downey, Ill.

• Helen R. Winston is now at the Veterans Hospital, Van Nuys, Calif.

• Patricia Barrett is leaving Duke to become a member of the physical therapy staff at George Washington Hospital in Washington.

• Edith Monro has accepted the position of physical therapist at the Kate Macy Ladd Convalescent Home, Far Hills, N. J. Dr. A. L. Van Horn, formerly Medical Director, Services for Crippled Children, Children's Bureau, is Medical Director.

Marriages

Frances Bond of Boise, Idaho, is now Mrs. Frances Sturgill.

Florence Carlyon of Madison, Wisconsin, is now Mrs. Florence Extrom.

Catherine Chassell of Beloit, Wisconsin, is now Mrs. Catherine Kitenplon.

Laurine M. Farness of Milwaukee, Wisconsin, is now Mrs. Laurine Clarke.

Geraldine Gray of Chicago, Illinois, is now Mrs. Geraldine G. Murchison.

Shirley Green of Chicago, Illinois, is now Mrs. Shirley G. Lovett.

Caroline Haines of Rochester, Minnesota, is now Mrs. Caroline H. Anderson.

Olive Hammond of Sennett, New York, is now Mrs. Olive H. Gilbert.

Patsy Lee Hemminger of Coral Gables, Florida, is now Mrs. Patsy Lee Raudenbush.

Louise G. Hutchison of Reading, Pennsylvania, is now Mrs. Louise H. Anthony.

Sylvia Luoma of North Hollywood, California, is now Mrs. Sylvia Hartman.

Marjorie Patterson of Peru, New York, is now Mrs. Marjorie P. Torrence.

Helen Renick of New York, New York, is now Mrs. Helen R. Auman.

Eyrlis Janet Riste of Seattle, Washington, is now Mrs. Eyrlis McClish.

Phoebe E. Romberger of West Lafayette, Indiana, is now Mrs. Phoebe R. Longley.

Mary C. Safris of St. Louis, Missouri, is now Mrs. Mary C. Keller.

Ella B. Turner of St. Louis, Missouri, is now Mrs. Ella T. Spath.

Chapter Activities

Carolina Chapter: The Southern District of the American Association for Health, Physical Education and Recreation met in Asheville, February 23-25. For the Therapeutic Section, Dr. Weston Cook, Cerebral Palsy Consultant, Division for Crippled Children, South Carolina State Board of Health, spoke on "Survey of Orthopedic Problems Encountered in the School Program." Helen Kaiser, Duke Hospital, Durham, discussed "Correlation of Follow-Up Care for Orthopedic Cases in School and Hospital" and also gave a demonstration of the technics.

The annual meeting of the Carolina Chapter was held in Winston-Salem, N. C., at the Bowman-Gray School of Medicine. A symposium on physical medicine was presented. Dr. Coy C. Carpenter, Dean, and Dr. Robert A. Moore, Assistant Professor of Surgery in Charge of Orthopedics, Bowman-Gray School of Medicine, gave welcome addresses. Dr. Angus Randolph, Psychiatrist, Grayland, spoke on "Psychiatry in Physical Therapy;" Dr. Richard Masland, Assistant Professor of Neuropsychiatry, Bowman-Gray, discussed "Emotional Problems of the Epileptic," and Dr. Eben Alexander, Assistant Professor of Surgery in Charge of Neurosurgery, Bowman-Gray, spoke on "Paraplegias." The afternoon sessions consisted of round table discussions with Mary Haskell acting as coordinator for discussion of "Allied Professions in a Program for the Physically Handicapped," and Dr. Josephine Buchanan coordinator for discussion of "Allied Agencies in a Program of the Physically Handicapped." The Sunday meeting had as guest speaker Dr. Robert B. Lawson, Associate Professor of Pediatrics, Bowman-Gray, who gave an address on "New Developments in the Treatment of the Acute Stage of Polio."

Eastern Michigan Chapter: The Michigan Department of Public Instruction and the Michigan Crippled Children's Commission held a Workshop in April which was designed to consider the joint problems of physical therapists and occupational therapists. The meeting was held at Higgins Lake Conservation Camp.

A tour of the Veterans Hospital, Dearborn, was arranged for May, and Dr. Joseph Markel, Director of Physical Medicine, spoke on "The Physical Management and Rehabilitation of Hemiplegias."

Iowa Chapter: The March meeting of the Iowa Chapter was held at the University General Hospital in Iowa City. Dr. H. M. Hines, Professor of Physiology at the University, and Norma M. Hajek, graduate student in Physiology, spoke on "The Physiological Basis for Certain Therapies in Poliomyelitis," and discussed the use of curare in experiments on animals. A social period followed at which time members were given an opportunity to meet Mary Haskell, National Secretary of the Association, who was a guest at the meeting.

Kentucky Chapter: Kentucky is planning ahead to meet future increased incidences of poliomyelitis.

Dr. Irvin Abell, Chairman, General Medical Advisory Committee, National Foundation for Infantile Paralysis, presided at a Conference of Interested State and Private Agencies in Louisville in April. Dr. Edward Press, Chicago, Regional Medical Director of the U. S. Children's Bureau, and Dr. Kenneth S. Landauer, New York, Director of Medical Care for the National Foundation, were present as consultants and moderators.

Following the conference dinner Doctor Abell announced the appointment of a Permanent Poliomyelitis Planning Committee. The Committee includes the President of the Kentucky Chapter. This is the first time this three-year old chapter has been recognized as one of the State's professional organizations.

Wisconsin Chapter: The Wisconsin Chapter held their last meeting at the Memorial Union, Madison. Guests for the meeting were Dr. and Mrs. Sture A. Johnson, and Mildred Elson. Doctor Johnson, Professor of Dermatology, Wisconsin General Hospital, showed a most interesting series of slides stressing the indications and contraindications of ultraviolet for each skin disease discussed.

New Members

• The following are newly accepted members of the American Physical Therapy Association:

Mabel Abray
Katherine A. Crossin
Vera R. Ford
Joan A. Seiver

• Recent graduates and former student members of the following schools:

Baruch Center of Physical Medicine:
Lt. Olive Mary Dennis
Lt. Maurine M. Meckes
Marjorie L. Gaskill

Hermann Hospital:
Jack C. Bean

Mayo Clinic:
Eleanore M. Binns
Meta Epsberg
Muriel Graslie

Northwestern University Medical School:
Mrs. Margaret G. Hogan

Simmons College:
Beatrice E. Cavan

University of Colorado:
Mrs. Winifred B. Hilde

University of Kansas:
Phyllis Ann Oliver

• *Student* members from the following schools:

Barnes Hospital:
Jack E. Field
Lois L. Guernsey
Mildred Ann Jahn
William M. Merritt
Natalie Anne McFee
Barbara Nash
Naomi Strong
Thomas J. Zwierlein

Bouve-Boston School of Physical Education:
Priscilla Bartlett
Nancy Bateman
Brenda Buchanan
Taimi Grekula
Sally Hale
Jeanne Hastings
Elaine Jacobs
Elva Piermarini
Dorcas Purdy
Irma Schnepper
Joan Secor
Hilda Toker
Joan Wilson
Beatrice Zink

Duke University School of Medicine:
Lilyanne Babskie
Eleanor W. Clardy
Albert Dankovich
Mary Ann Day
Richard Fitzgerald
Rosemary E. Garrett
William M. Hensley
Oliver S. Kendrick
Eunice K. Morrow
Gertrude Osborne
Sally Jim Wilhoit
Ernest V. Williams

D. T. Watson School of Physical Therapy:
Margaret W. Bailey
Joann Belz
Agnes Bettinger
Julia E. Collins
Jeanne M. Flickinger
Madlen C. Fritz
Lloyd B. Hanson
James R. Hayhurst
Mary E. Hile
Margaret M. Kohler
Mary Marker
Dave J. Nemeth
Nancy Lee Nicklas
Herman D. Person
Vincent A. Puglisi
Frances Pollak
Margaret E. Slaney
Gene Rose Vitala
Hilda F. Zakel

Children's Hospital, Los Angeles:
Virginia E. Bain
Beverly Ball
Mary Rose D'Anna
Joann Dyer
Maxine Holtzclaw
Gertrude Elson McDowell
Elizabeth S. Morrill
Marion B. Rudolph
Anita M. Paul
Augusta Rojaks
Ruth B. Smith
Mrs. Irene Yuguchi
Shirley G. Snyder
Jane C. Turner

University of Kansas:
Ruth Boyce
Carolyn Ruth Covert
Patricia Lou Norcross
Carolyn Keith
William A. Valle
Melvin Carson
Georgia E. Jackson
Jack M. Maddux
Wilma Martin
Arthur Wilson

Correction

An error occurred in the listing of "New Members" in the April 1949 issue of the REVIEW. All those listed as newly accepted *student* members should have been listed as *active* members, except those from Columbia University, who are newly accepted *student* members. All were former student members except June L. Morton.

General News

• Mary M. Roberts, Editor-in-Chief of the American Journal of Nursing, and one of the nation's foremost nurse leaders, has retired after twenty-eight years of service with that publication. She will be succeeded by Nell V. Beeby, who has been associated with Miss Roberts in the capacity of Editor of the American Journal of Nursing. The Board of

Directors announces that in retiring as Editor-in-Chief, Miss Roberts will not retire from active participation in the nursing field. They have asked her to undertake a comprehensive writing assignment.

The Mary Adelaide Nutting award, given by the National League of Nursing Education for outstanding contributions to the advancement of nursing, both in this country and abroad, was presented to Miss Roberts at the recent convention of the National League of Nursing Education.

• The National Society for Crippled Children and Adults has compiled "A Bibliography on Employment of the Physically Handicapped." This is an author-subject index to literature in the Library of the National Society. A single copy of this bibliography will be sent without charge to all persons who may care to request it. Inquiry for prices of quantity lots are invited and should be directed to the Library, National Society for Crippled Children and Adults, Inc., 11 South La Salle Street, Chicago 3, Illinois.

• The New York State Occupational Therapy Association recently sponsored a Neurological Institute at which the following papers were presented: "Peripheral Nerve Injuries" by William Tomasco, M.D., Miss Schnelbaker, P.T., and Clare Spackman, O.T.; "Multiple Sclerosis" by Daniel Sciarra, M.D., and Sophie Ackerman, O.T.; "Hemiplegia" by Temple Fay, M.D., and Jon Eisenson, M.D., and "Evaluation of Neurological Disabilities" by Donald Covalt, M.D., and James Garrett, M.D. These papers are obtainable in pamphlet form (price, $1.10 including postage) by writing Mrs. Ruth Moorehouse, O.T.R., Veterans Administration, Halloran Hospital, Staten Island, N. Y.

Civil Service Examinations for Physical Therapist

A new examination for Physical Therapist has just been announced by the Civil Service Commission for filling positions in the Public Health Service, the Children's Bureau, and St. Elizabeths Hospital in Washington, D. C., and in the U. S. Public Health Service and Marine Hospitals throughout the United States.

Salary is based on the standard Federal workweek of 40 hours. Additional compensation is provided for any authorized overtime worked in excess of the 40-hour week. Entrance salary, $2,974.80. Periodic pay increases of $125.40 a year up to the maximum of $3,727.20 are provided by law, following the completion of each 12 months of service, for employees whose services meet prescribed standards of efficiency. A Federal employee serving in a position in the competitive civil service, at a salary above the basic entrance salary for the position in which he is appointed or classified from this examination, may continue to be paid at his current salary rate if it is not beyond the maximum salary for the position in which he is appointed or classified. All basic salaries are subject to a deduction of 6 per cent for retirement benefits.

To apply for this examination, file the material listed below:

(1) Form 57. Be sure to show the title of the examination and the number of the announcement (No. 169).

(2) Card Form 5001-ABC.

(3) Form 14, with the documentary proof required therein, if you are claiming veteran preference and if the form is required in your case.*

(4) Form 12 (proof of residence), if the form is required in your case.*

These forms may be obtained from any first- or second-class post office, except in regional headquarters cities, where the forms must be obtained from the United States Civil Service Regional Offices. Forms also may be obtained from the United States Civil Service Commission, Washington 25, D. C.

Send applications to the United States Civil Service Commission, Washington 25, D. C. Applications will be accepted until further notice.

*For complete details, write to the United States Civil Service Commission, Washington 25, D. C., for Announcement No. 169 (Unassembled)..

Medical Materials Requested

The National Committee for Chile is now receiving gifts for the Library of the Medical School of the University of Chile at its new collection center in the Library of Congress, Washington. The newer materials in the Library, including periodicals, books and reference materials, were totally destroyed in a recent fire. Medical periodicals of the last ten years and recent medical books are urgently needed. Your contribution will be appreciated, and should be sent to: National Committee for Chile, Room 318, Library of Congress, Washington, D. C.

Workshop in Physical Therapy

Stanford University will hold its annual Workshop in Physical Therapy, August 15-27, 1949. Pertinent information regarding the Workshop is as follows:

Courses: 227 Physical Therapy in Cerebral Palsy —2 units

242 Functional Activities for the Handicapped—2 units

Tuition and Fees: Graduate students—$65 for 4 units of credit. ($5 application fee for new students). Auditors—$20 total for the two courses.

Application for Admission: For new graduate students, regular admission procedure is required. Fill out application blank (mailed on request) and send with copy of transcripts to Registrar's office. Fill out Workshop application sheet and return to Division of Physical Therapy, Stanford University.

For graduate students who have previously attended Stanford and Auditors, fill out Workshop application sheet and return to Division of Physical Therapy, Stanford University, California.

Staff: Robertine St. James, Supervisor of Physical Therapy, Children's Rehabilitation Institute, Cockeysville, Maryland, will be visiting instructor for the course in the treatment of cerebral palsy. Margaret Knott, Chief Physical Therapist, Kabat-Kaiser Institute, Vallejo, California, will demonstrate technics used in that institution for the treatment of cerebral palsy. Members of the staff of the Rehabilitation Center of San Francisco and the Division of Physical Therapy at Stanford will be instructors for the course in functional activities.

Living Accommodations: Women students Lagunita Court—$55 for room and board for two-week period. Men students—Encina Commons—$47 for room and board for two-week period. Men or women students—Guest House, Stanford Village—$7.50 per week for single room, $6.25 per week for double room. Breakfast and lunch available on grounds.

Institute on Teaching Body Mechanics in Nursing

The Vanderbilt University School of Nursing will conduct a two-weeks' Institute on Teaching Body Mechanics in Nursing, July 11-23, 1949.

The program is planned for instructors in nursing to (1) orient them to principles of body mechanics which promote health through efficient use of the body, and (2) provide opportunity for group study of methods of including these principles in the nursing curriculum.

Staff: The Institute will be under the direction of Mrs. Margaret Winters, Jessie L. Stevenson and Jane Sloan, who are orthopedic nursing and physical therapy specialists of the faculty. Other members of the clinical nursing faculty will participate.

Admission: The course is open to teachers and supervisors in schools of nursing and public health agencies, and to consultants in the various fields of nursing. Applicants for admission should hold a baccalaureate degree. Enrollment will be limited.

Fee: The fee for the Institute will be $50, payable at registration.

Housing: Rooms will be available in the Maxwell House—double rooms with bath at $2.50 per day per person. A limited number of rooms in the vicinity of the campus may be available. Reservations may be made through the Office of the Dean.

Applications should be made to: Office of the Dean, School of Nursing, Vanderbilt University, Nashville 4, Tenn.

Women's Medical Specialist Corps

• The Surgeon General of the Army announces the recent promotion of the following Physical Therapists in the Women's Medical Specialist Corps to the permanent grade of Captain in the Regular Army:

Name	*Present Address*
Catherine M. Bender	20th Station Hosp., Philippine Islands
Mary BenDure	387th Station Hosp., Germany
Martha M. Boger	Station Hosp., West Point, N. Y.
Ruth W. Bradley	Madigan Gen. Hosp., Tacoma, Wash.
Belle K. Cohen	Tilton Gen. Hosp., Fort Dix, N. J.
Emily Fairbanks	Walter Reed Gen. Hosp., Washington, D. C.
Elizabeth Fowler	Tilton Gen. Hosp., Fort Dix, N. J.
Virginia Frost	Tilton Gen. Hosp., Fort Dix, N. J.
Ada E. Gray	Student at Georgia Warm Springs Found., Warm Springs, Ga.
Grace McNee Heltman	Percy Jones Gen. Hosp., Battle Creek, Mich.
Savinah Shockey	183rd Gen. Hosp., Alaska

These are among forty promotions to this grade, the first to be accomplished since the establishment of the Women's Medical Specialist Corps.

• The Surgeon General of the Army announces the recent promotion of the following Physical Therapists in the Women's Medical Specialist Corps to the temporary grade of Captain:

Name	*Present Address*
Marcel Binning	Army & Navy Gen. Hosp., Hot Springs, Ark.
Dorothea Fleischer	Station Hosp., Fort Belvoir, Va.
Cesira A. Frazy	Fitzsimons Gen. Hosp., Denver, Colo.
Dorothy B. Locke	Station Hosp., Fort Monmouth, N. J.
Julia M. Mikals	Station Hosp., Chanute Field, Ill.
Inez Moffitt	Percy Jones Gen. Hosp., Battle Creek, Mich.

Millicent J. Murrell	Brooke Gen. Hosp., Fort Sam Houston, Tex.
Adelina E. Pirone	Murphy Gen. Hosp., Waltham, Mass.
Flora M. Rand	Wm. Beaumont Gen. Hosp., El Paso, Texas
Corrine C. Rizzo	Brooke Gen. Hosp., Fort Sam Houston, Texas
Alice Valentine	Station Hosp., Fort Bragg, N. C.

These are among the first of such promotions since the passage of Public Law 36 on April 16, 1947, which authorized the establishment of the Women's Medical Specialist Corps.

REPRINTS AVAILABLE

One free copy of each scientific reprint (except the History of the American Physical Therapy Association, and the Anterior Poliomyelitis and Cerebral Palsy Issues of the REVIEW will be provided upon request to all members, students in the approved schools and libraries. A small charge is made as indicated for additional copies to members, students and libraries, and for all copies to nonmembers. The informational brochures are available to all without charge. To obtain reprints write: American Physical Therapy Association, 1790 Broadway, New York 19, N. Y.

PHYSICAL THERAPY, A SERVICE AND A CAREER
An illustrated brochure, describing the opportunities for a career in physical therapy, available scholarships and educational requirements for entering a school of physical therapy. (Made available through National Foundation for Infantile Paralysis funds.)

OUR ASSOCIATION
An informational booklet on the activities, scope and services of the American Physical Therapy Association.

PHYSICAL THERAPY
A question and answer article covering the usual queries received on physical therapy.

PHYSICAL THERAPY—*Suggestions for Prospective Students.*
Outlines the professional course of study for college students preparing for physical therapy.

PHYSICAL THERAPY SECTION: *Its Scope and Employment Opportunities.*
This consists of 12 articles by various contributors on physical therapy in a state crippled children's service, public health service, the cerebral palsy field, the Veterans Administration, the industrial clinic, a curative workshop, a large general hospital, a small general hospital, a children's hospital, crippled children's schools, the physician's office or clinic group and the psychiatric field.

CODE OF ETHICS
Ethics for the physical therapist of the American Physical Therapy Association.

PERSONNEL POLICIES FOR QUALIFIED PHYSICAL THERAPISTS
Suggestions as to salary, hours, vacations, etc., by the American Physical Therapy Association.

APPROVED SCHOOLS OF PHYSICAL THERAPY
A list of schools approved by the Council on Medical Education and Hospitals of the American Medical Association.

EDUCATIONAL OPPORTUNITIES FOR PHYSICAL THERAPISTS.
A list of postgraduate programs offered by the approved schools and a list of specialized courses for physical therapists.

CARE OF PATIENTS WITH INFANTILE PARALYSIS: *Correlation in the Nursing and Physical Therapy Services.*
CARMELITA CALDERWOOD HEARST (5c)

POSTURE TRAINING FOR ADOLESCENTS
CAROLYN BOWEN (5c)

THE ORTHOPEDIC SURGEON AND CO-WORKERS IN THE TREATMENT OF POLIOMYELITIS.
C. L. LOWMAN, M.D. (5c)

THE PHYSICAL THERAPIST AND CO-WORKERS IN THE TREATMENT OF POLIOMYELITIS.
LUCILLE DANIELS (5c)

INTEGRATION OF PRINCIPLES OF BODY MECHANICS AND POSTURE IN NURSING: *Demonstration Project at Vanderbilt University School of Nursing.*
MARGARET C. WINTERS. (10c)

PHYSICAL THERAPY AND CHEST SURGERY
FLORENCE S. LINDUFF. (10c)

BED EXERCISES IN EARLY CONVALESCENCE AND AMBULATION.
NILA K. COVALT, M.D. (10c)

THE RESPIRATOR IN THE TREATMENT OF ACUTE POLIOMYELITIS.
DOROTHY GRAVES. (10c)

PHYSICAL THERAPY MANAGEMENT OF LOWER EXTREMITY AMPUTEES.
PAIGE WEAVER. (10c)

TOYS, GAMES AND APPARATUS FOR CHILDREN WITH CEREBRAL PALSY.
GLADYS G. ROGERS AND LEAH THOMAS. (10c)

FUNCTIONAL TESTING AND TRAINING: *Physical Therapy Aspects.*
ROBERT L. BENNETT, M.D., AND HAZEL R. STEPHENS. (15c)

GUTHRIE-SMITH APPARATUS: *Its Construction and Use in Rehabilitation.*
KATHRYN S. BIER (20c)

THE PHYSICAL THERAPY REVIEW—*Special Anterior Poliomyelitis Issue.* July-August 1947 (75c)
The magazine contains 11 articles by leading physicians and physical therapists on research and treatment of polio. There are 16 abstracts of articles on polio from current medical journals.

A HISTORY OF THE AMERICAN PHYSICAL THERAPY ASSOCIATION.
IDA M. HAZENHYER. (50c)
An account of the Association's activities and growth from 1921-1946.

THE PHYSICAL THERAPY REVIEW—*Special Cerebral Palsy Issue.* May-June 1948 (75c)
This magazine contains 8 articles by leading physicians and physical therapists on research and treatment of cerebral palsy. There are 5 abstracts of articles on cerebral palsy from current medical journals.

Available free of charge from Joint Orthopedic Nursing Advisory Service, 1790 Broadway, New York 19, N. Y.:

MAKING PHYSICS A PART OF THE CURRICULUM: *Three methods of incorporating physics in the nursing school curriculum.*
HESSEL H. FLITTER, R.N.

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The Quadriceps in Relation to Recovery from Injuries of the Knee-Joint. I. S. Smillie. Physiotherapy, April 1949.

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To Combat Cerebral Palsy. Donald J. Bourg. The Child, April 1949.

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Three R's for Parents. Chauncey H. Whitner. The Crippled Child, April 1949.

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Swimming is Healthful, but . . . Charles LeRoy Lowman. The Crippled Child, April 1949.

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Tendon Transfers and Arthrodeses in Combined Median and Ulnar Nerve Paralysis. J. William Littler. J. Bone and J. Surg., April 1949.

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Experiments on Normal Temperature Regulation. Samson Wright. Brit. Med. J., April 9, 1949.

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Functional Testing and Training in Physical Medicine. Robert L. Bennett. Arch. Phys. Med., May 1949.

Physiologic and Medical Principles of Training. Jack E. Lovelock. Arch. Phys. Med., May 1949.

Abstracts

John S. Coulter, M.D.

Physiologic and Medical Principles of Training

Jack E. Lovelock, B.M., New York. In ARCHIVES OF PHYSICAL MEDICINE, 30:5:291, May 1949.

Training is a comprehensive term whose specific aim should be clearly defined. It is essentially a preparation of the total individual, mind and body. The first necessity is an adequate inherited physique, on which are grafted the acquired properties. The ultimate limiting factor is motivation, arising from psychologic causes.

In training, which can be regarded as a branch of preventive medicine, physiatrists have a real part to play. The raising of the general physical health by proper food, adequate rest and controlled exercise are medical problems, as are also advice on the value of fresh air and sunshine, alcohol and tobacco, baths and massage, clothing, shoes and general hygiene. It is time that medically qualified persons assumed their full responsibility in the supervision of training for all purposes. Their scientific background should be used to develop the health of the nation.

Transfusions of Blood From Pregnant Women for Rheumatoid Arthritis

Editorial. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:11:718, March 12, 1949.

The beneficial effect of thirty of thirty-four pregnancies in 20 patients with rheumatoid arthritis was reported in 1938 by Hench. A "marked" to "complete" remission of the arthritis resulted. Seventeen of the 20 patients experienced notable relief of their rheumatoid arthritis each time they became pregnant. Articular relief began during the first trimester in about 90 per cent and in the second trimester in about 10 per cent of the patients who experienced amelioration. Relief was complete in about 60 per cent of effective pregnancies, almost complete in about 15 per cent and notable in the remaining 5 per cent. After parturition, the phenomenon of articular relief ended in about 50 to 55 per cent of the cases within one to seven weeks, and in between eight and twelve weeks in 10 per cent. Relief rarely lasted from four to twenty-four months. The factors of lactation, length of time in bed and approach of postpartum menses did not govern the duration of postpartum relief. Rheumatoid arthritis rarely begins during pregnancy. Hench concluded that pregnancy initiates a physiologic state which is decidedly beneficial (at least temporarily) to patients with rheumatoid arthritis (as well as to those who have certain other rheumatic disorders).

Physical Treatment of Common Disorders of the Feet

Frances Baker, M.D., San Francisco. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:16:1057, April 16, 1949.

Physical therapy should be used to accomplish a particular result. For this reason, when disorders of the feet are to be treated, a clear knowledge of the etiologic aspects of the condition is needed, and the plan of treatment should have a logical reason.

For many years there have been lists of exercises described with the general idea of strengthening the feet. In a vague sort of way, painful feet have been considered weak feet, and exercises have been prescribed to strengthen them. Needless to say, exercises can be done for only a small part of each day; yet the patient probably is forced to bear weight many hours of that day. The muscles of the feet cannot be weaker than muscles elsewhere in the body, so that there is no reason for planning strengthening exercises for the feet alone.

This paper is limited to a discussion of treatment of the common disorders of the feet. The primary causes for most obvious distortions are:

(1) A failure of full evolutionary development which is evidenced by variations of the first metatarsal segment or of a metatarsus varus.

(2) Muscular contractures of hamstrings, calf muscles or the plantar muscles and fascias which result in pes equinus or pes cavus.

(3) Hyperflexibility of ligaments which results in pes valgus.

(4) Such congenital or developmental anomalies as pes equino varus, accessory scaphoid bones, calcaneonavicular coalitions and epiphysitis which can cause strain and variations from the normal alinement.

(5) Pathologic conditions which cause paralyses or arthritis and present themselves here as in other parts of the body.

Treatment.—It has been emphasized that attempts at correction of the causative factors leading to the common foot disorders and the careful choosing of shoes to permit the best alinement of the feet are of first importance in the treatment of the primary variations from normal. Exercises to develop muscular power have no place in treatment of foot strain. If the general bodily musculature has been weakened by any debilitating condition, then reconditioning exercises are of importance for the muscles of the feet as they are for all muscles of the body. The idea of the relief of strain by "foot exercises" is built on a false premise.

Physical Treatment: Physical treatment is absolutely necessary for the relief of acutely painful feet. Where there has been severe strain, the pain with its accompanying muscular guarding or spasm must be controlled before more permanent management of the underlying cause can be instituted. When physical treatment is given, the patient should be in the supine position for the purpose of obtaining general relaxation. Spasm and pain are most easily controlled with large hot packs wrung as dry as possible. Whirlpool, hot bath or contrast baths are helpful. Radiant heat or diathermy may so affect the ligaments or periosteum as to increase rather than decrease the pain. After thirty to forty minutes the wet heat should be followed with very light stroking (effleurage) massage. The massage can be gradually deepened, but it must not cause pain at any time. As the foot relaxes under this treatment, slow carefully controlled movement in all directions will help to indicate whether the spasm has been released. It may be necessary to strap the foot with adhesive tape or to bandage it with an ace bandage. If absolute rest is necessary, it should be arranged. This program should be continued until the immediate pain is controlled. Then further studies can be made as indicated and a plan for control of the disorder can be made.

Physical treatment is required for the reduction of muscular contractures. When pes cavus is noted in the baby, casts should correct the shortening in both the heel cords and the plantar tissues. If no treatment is started until childhood, then a special program of stretching should be prescribed before surgical treatment is considered.

Physical treatment is necessary in the mobilization of joints that have become limited in range secondary to various etiologic factors. Traumatic arthritis frequently is at the first metatarsophalangeal joint where there is faulty weight bearing as described earlier under metatarsal variations. There may be clawing hammer toes. Contractures of soft tissue may result from rheumatoid arthritis or from various types of paralysis. If pain is present, radiant heat, wet heat or paraffin may be used for twenty to thirty minutes, followed by massage and stretching. The massage can be deep stroking, kneading or friction, but it must not be painful.

Physical treatment is used to reeducate muscles to normal movement after deformities have been corrected. A short heel cord will throw a foot into pronation. When this has been relieved, shoes are fitted to hold the foot in correct position, but it often is necessary to stimulate the tibialis anticus and posticus actively to lift the medial side of the foot in walking. The peroneus tertius also may need retraining before the patient will dorsiflex his foot and reach correctly with the heel as is required in normal locomotion. Activity of the dorsiflexors of the toes must be controlled, as they are overactive when contractures have been present which prevent the normal dorsiflexion of the ankle by the tibialis anticus and peroneus tertius.

Conclusions

The proper treatment of the common disorders of the feet rests on a careful analysis of the etiologic factors. If the condition can be recognized in infancy, prevention or correction may be obtained. In the older child or adult, treatment depends on (1) the choice of shoes to fit the patient's feet, (2) relief of severe pain, (3) obtaining complete range of motion of joints through elongation of any soft tissues that may be limited by whatever cause and (4) education to a correct gait.

New Method in Management of Acute Anterior Poliomyelitis

E. Smith, D. J. Graubard, N. Goldstein and W. Bikoff. In NEW YORK STATE JOURNAL OF MEDICINE, 48:2543, Dec. 1, 1948. Abstracted in JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 193:16:1114, April 16, 1949.

Smith and his associates regard the alleviation of pain and spasm as one of the major problems in the management of acute poliomyelitis. They believe that vasospasm is a defense mechanism of tissue response. When an irritable focus is established in the periphery, the organism reacts by vasospasm and exudate. These usually subside at the time healing is complete. However, if an irritative focus persists, a reflex arc producing pain and spasm is established. This arc may perpetuate itself through the internuncial pool and eventually involve the sympathetic motor neuron cells in the lateral horn. Interruption of the cycle of reflexes is, therefore, the method of choice. The results achieved in cases of trauma with the intravenous administration of procaine hydrochloride have indicated that the symptom complex of pain may be controlled in this way. The treatment described was used in 79 of 159 patients with poliomyelitis. Four patients were treated by the intravenous administration of procaine hydrochloride; 73 were treated with priscol hydrochloride (2-benzyl-4, 5 imidazoline hydrochloride) and 2 with diethylaminoethanol. Acute pain was relieved in all cases within twenty minutes to eight hours, procaine hydrochloride giving the quickest and diethylaminoethanol the slowest response. Increasing relief of pain was obtained with succeeding administration to the point of complete relief, at which time the patients were discharged or transferred to orthopedic institutions. Although relief of pain and spasm was obtained in all cases, this report must be considered as a preliminary study.

Physical Treatment of Peripheral Vascular Disease

Sedgwick Mead, M.D., St. Louis. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:16:1059, April 16, 1949.

In no other set of conditions is a proper balance between medical, surgical and physical methods of treatment more essential than in diseases of the peripheral circulatory systems. Rational therapy must be based first of all on a thorough understanding of their anatomy and physiology, both normal and morbid; secondly, on accurate methods of evaluation, and, finally, on a thorough knowledge of all methods of treatment and of judgment and discrimination in their application.

An attempt is made in this presentation to emphasize the most widely held views of authorities in the field of vascular disease.

Diseases of Lymph Vessels

Hot fomentations and elevation are standard treatment in lymphangitis and lymphadenitis of both the upper and lower extremities, whether incited by puncture wounds or by fungous infections. Luminous heat and hot tub baths may be used. Lymphedema, whether congenital (Milroy's disease) or secondary to trauma, tumor or infection, should be treated by elevation of the extremity, centripetal massage and tight bandaging. Neglect results in fibrosis (elephantiasis), which can be treated only surgically.

Diseases of Veins

Stagnation of venous blood in the calves or perivesical plexus is at least one factor in the production of phlebothrombosis and phleboembolism. Once these grave conditions have developed, physical treatment is contraindicated. The simplest and most effective prophylaxis is properly carried out bed exercises. It is highly desirable that all persons treated with prolonged bed rest perform such exercises, especially in pelvic postoperative states and in cardiac decompensation. Dorsiflexion, toe fanning and curling, inversion, eversion and isometric plantar flexion against a footboard should be performed in ten to thirty repetitions, at least three times daily.

Once frank thrombophlebitis has developed the danger of embolism is regarded as past, although not necessarily in the opposite, apparently uninvolved, leg. In thrombophlebitis the leg should be elevated 15 cm. (6 in.) above the heart level. The foot of the bed may be placed on blocks. Rest is essential. Deep breathing, straining at stool and elaborate physical examination of the chest should be avoided as long as there is any hazard of embolism. Many types of heat may be used. Hot packs probably are best. Massage is contraindicated.

Diseases of Larger Arteries

Functional diseases of the larger arteries include cervical rib and scalenus syndrome, hyperabduction syndrome of Wright and costoclavicular syndrome of Flaconer and Weddell. Many patients in this group can be successfully treated by postural exercises alone. Others will require surgical cure. Special arrangement of pillows at night, luminous heat, head traction and massage may be required. In Wright's syndrome it is necessary only to bind the wrists loosely to the foot of the bed at night. Those doing overhead painting or lubricating may need to shift to a different job. In costoclavicular syndrome (first noticed in soldiers wearing heavy packs) the upper trapezius and levator scapulae should be strengthened by appropriate therapeutic exercises.

Diseases of Small Arteries and Arterioles

Raynaud's symptoms usually are so mild as to require no special treatment. In Raynaud's disease the main point is avoidance of cold. Special heaters may be used for gloved hands and feet only for the prevention of attacks; the patient must be warned of the danger of burns in the use of such devices during attacks. Treatment of reflex or Sudeck's atrophy (secondary to trauma) is unsatisfactory. Shoulder-hand syndrome may belong to this group. Vigorous hydrotherapy, massage and therapeutic exercise should be administered for an extended period. Results are only fair. Erythromelalgia, the semiologic opposite of Raynaud's disease, requires the opposite prophylaxis—avoidance of heat. Acrodynia has some similarities.

Raynaud phenomena may occur in leukemia, rheumatoid arthritis and the "group" or diffuse collagen diseases: lupus erythematosus disseminatus, scleroderma, dermatomyositis and periarteritis nodosa. The last named, when the cause of neuritic or joint pain, may be treated by whirlpool baths. Heat should be used with caution when the cutaneous sensory nerves are affected. Insolation and ultraviolet rays should never be used in lupus erythematosus because of the danger of provoking fatal dissemination. In scleroderma localized to the hands and forearms, paraffin baths followed by vigorous massage and acetyl-beta-methylcholine chloride iontophoresis may be tried (0.1 to 1.0 per cent solution; 15 milliamperes for thirty minutes). In the generalized form of the disease no treatment is of avail. It may affect the face, mouth, esophagus and even the heart.

Structural diseases of the small arteries include most of the important groups of arterial insufficiency seen clinically. It is insufficiency of the small vessels that eventually leads to claudication, muscle infarction and gangrene. It is here that physical agents have their greatest utility in treatment.

Meticulous cleanliness and the avoidance of thermal, chemical and mechanical trauma are the first requirement. Care in the trimming of toe nails and corns and in the prevention of fungous dermatoses goes without saying. The extremity is lowered 15 cm. below the heart level. A cradle with protected carbon bulbs providing an ambient tempera-

ture of 31 to 35 C. (88 to 95 F.) will produce the right amount of vasodilatation without dangerously raising the tissue temperature. Patented thermostatic devices are safe and effective. Even more complete relaxation of the arteriolar walls can be procured by indirect heating of one or more normal extremities. Diathermy, luminous heat, paraffin and water baths, and electrically heated sleeves have been employed. In diffuse peripheral vascular disease the diathermy application may be safely made over the pelvic area. Such treatment can be used only a limited number of hours per day, because it is somewhat exhausting. Whirlpool baths may be used. Contrast baths are physiologically unsound.

Despite their somewhat shaky physiologic background, the Buerger-Allen exercises have one excellent theoretical basis: They may aid in the establishment of collaterals by tissue demands short of claudication.

The patient is provided with a printed instruction sheet with diagrams of the various positions and with a time schedule individually determined for him by noting how long it takes for pallor to develop on elevation and rubor on dependency. During dependency exercises similar to those described under prophylaxis of thromboembolism are carried out. The exercises should be carried out for one hour, three times daily.

Passive exercises include suction-boot apparatus, intermittent venous occlusion and the Sanders oscillating bed. Of these, strangely enough, the one with the best background of physiologic experimentation (Hermann, Landis and Hitzrot) has fallen into the greatest disuse. The objections to the alternating suction and pressure boot are largely practical: its effect is too transient, it is bulky and it is irritating to the skin. The intermittent venous occlusion apparatus (Collens and Wilensky), on the other hand, is small and portable, not greatly expensive, not irritating to the user and can be operated for prolonged periods of time without attention and without danger. The senile, petulant or confused patient may not tolerate it, however, any better than he does his in-lying catheter. Convincing physiologic experimentation on the effect of this apparatus is still lacking, although some apparently well carried out clinical studies have been made by its sponsors which sound convincing. Some writers feel that in order to be effective it must be used in the patient's home daily (one or two hours) for six months or more and that its predominant effect is the establishment of collaterals.

The oscillating bed is expensive. It can be used to some extent with uncooperative patients. Those experienced in its use are enthusiastic.

Diseases of the Smallest Blood Vessels

For ulcers hydrotherapy and ion transfer of either histamine or acetyl-beta-methylcholine chloride are useful. Decubiti are ischemic ulcers produced by compression of a thin tissue between a mattress or cast and a bony prominence. Ion transfer and whirlpool treatment also are important here.

Some authorities have expressed the belief that the pathologicophysiologic aspects of frostbite and trench or immersion foot are identical and others that they are dissimilar. Until this debate is settled, the treatment of these conditions remains somewhat tentative. It is agreed, however, that in no instance should the involved part (in the acute stage) be either too rapidly warmed or kept too cold. The extremity should be brought gradually to room temperature (20 to 22 C.). Walking must be avoided in the early stages. Slight elevation is desirable to reduce any edema (particularly frequent in immersion foot). No constricting clothing of any sort may be permitted about the extremity.

In the chronic stage invalidism can be needlessly prolonged by neglecting early bicycling and walking instruction. Dogged insistence on these points and on exercises for the intrinsic foot muscles will prevent the severely disabling degrees of bone atrophy and ligamentous relaxation which result from inactivity. Paresthesias are stubborn. They can be helped by hydrotherapy and massage. For the hands, suitable shop and occupational therapy should be prescribed for recovery of joint motion (especially of the phalanges), work tolerance and skill. For the feet bicycle jig saws, treadle looms and other appropriate apparatus may be used. After loss of a limb or a part, training in a new vocation may be necessary. Throughout this discussion it is assumed that patients hospitalized for weeks or months, and therefore consumed with boredom, should be provided with diversional and morale occupational therapy.

Conclusion

It should be emphasized that in the physical treatment of vascular disease good judgment is more important than elaborate equipment. Ingenious improvisations, of which one saw so much during the late war, often serve well. One must avoid placing too much responsibility on the therapist, who, unless provided with a complete, thoughtful and detailed prescription, tends to fall into a routine rut. If the physician is vague about the objective of his treatment and imprecise in ordering its details, he can scarcely hope that the therapist will be any less vague in its execution. If he fails to observe that the patient has loss of pain and temperature perception, he should not blame the therapist for producing a diathermy burn. On the other hand, he cannot personally check every phase of the treatment. His only protection is to insist that the therapist be registered and a graduate of an accredited school.

Microwave Radiations

Current Comment. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:14:926, April 2, 1949.

Osborne and Frederick have studied the effect of microwave radiations on the living tissues and particularly on the eye. The radiations were formed by the Raytheon microtherm which generates energy in a continuous wave, air-cooled magnetron oscillator tube, the first generator of this type to be developed for the heating of human tissues. After exposure of thighs of dogs to high frequency energy, the maximum temperature was observed in the subcutaneous level and decreasing temperatures were found with increasing depths. In 7 "acute" experiments on dogs the eye was exposed to microwave radiations. Evidence of damage to the eyes or contiguous tissues did not appear. In twenty-four experiments on human subjects the thigh was exposed to microwave radiations. The treatments were comfortable to the patients and a minimum of erythema was noted. Worden and his associates report experiments on the temperatures of the skin, subcutaneous tissue, superficial muscle and deep muscle of the thigh of the dog after exposure to microwaves with the circulation intact and after ischemia produced by clamping the abdominal aorta. The temperature rises in the ischemic tissues were slightly higher than in normal tissues but were not considered significant after five or ten minutes of exposure, nor was there any evidence of burning after exposure for these shorter periods. After fifteen to twenty minutes of exposure the increased temperatures in ischemic tissues were considered significant with gross evidence of burning in most of the animals. The authors conclude that temperature tolerated by normal tissues cannot be regarded as the safe range of tolerance for ischemic tissues. Bony prominences were potential sites for formations of blebs. Richardson and his associates, utilizing the Raytheon microwave generator, produced cataractous lenticular opacities in rabbit eye after a direct single exposure. Until further data are accumulated, precaution should be observed in the use of microwaves in the region of the face and orbit.

Effect of Abdominal Ice Pack on Recovery From Fatigue

W. W. Tuttle, W. P. Happ and M. Wilson, Department of Physiology, State University of Iowa, Iowa City, Iowa. In FEDERATION PROCEEDINGS, 8:1:167, March 1949.

It has been reported that cold hip baths were employed in Germany during the last World War in both industry and the air force, to ward off the onset of fatigue and to hasten recovery from it. It is the purpose of this investigation to gain further information relative to the beneficial effects of the local application of cold on recovery from fatigue. The problem was approached by comparing the maximum amount of work a subject would do on a bicycle ergometer in one minute of maximum effort before and after a 10-minute rest, both without and with an ice pack applied to the abdomen during the rest period. Eleven graduate men ranging in age from 25 to 35 years, and in weight from 130 to 200 pounds, served as subjects. A study of the data showed, that in every case, the drop-off in work following a rest period with an abdoninal ice pack was significantly less than when the ice pack was omitted. The mean drop-off in work for the subjects when the abdominal ice pack was omitted from the rest period was 225 kg. M. and when ice was applied the mean drop-off was 69 kg.M. This difference is significant at the 1 per cent level of confidence. It was also observed that for the most part, the application of abdominal ice packs between bouts of strenuous exercise alleviated the symptoms of exhaustion such as dizziness, nausea and muscular weakness.

Primer on the Rheumatic Diseases: Part II

Prepared by a Committee of the American Rheumatism Association. In JOURNAL OF THE AMERICAN ASSOCIATION, 193: 17:1139, April 23, 1949.

Rheumatoid Arthritis

Muscular weakness and atrophy are prominent in rheumatoid arthritis and in some cases constitute the most striking features. Atrophy usually is particularly noticeable in the muscles of the hands, but it also occurs in all the muscles of the extremities and contributes to the fusiform appearance of the joints. In the opinion of the majority of observers the muscular atrophy is an integral part of the disease and is not solely attributable to the two known factors—disuse and muscular malnutrition—associated with persistent contraction.

Rest probably is the most important single measure in the treatment of this disease—rest for the body as a whole and rest for the inflamed joints in particular. However, in prescribing rest, intelligence and insight are necessary. The amount of rest varies from confinement in a hospital for six weeks to one year for the patient with severe disease to breaking the day with a two-hour rest period when the disease is mild. Rest must be regulated carefully. It is never necessary to prescribe absolute bed rest. Even in the case of most severe disease, mild muscle setting exercises should be prescribed and should be increased as the patient improves. Each case must be considered on its own merits. For local rest, suitable splints of the "gutter" type are of great assistance.

In no disorder of the joints is the prevention of deformities of greater moment. The deformities are too often due to neglect and, to a great extent, can be prevented by skilful use of splints. For the prevention and correction of hand deformities light aluminum splints usually are used, but for other joints deep "gutter" splints of plaster are preferable. These are worn only part of each day and at night in most cases, although for the correction of existing contractures continuous use is sometimes advisable for short periods. In rheumatoid spondylitis, a suitable brace during the day and a plaster shell to sleep in may prevent the spine from becoming rigid in a faulty position. In general, when stiffness and pain are severe, weight bearing should be restricted. When weight bearing is allowed, shoes which give some support should be prescribed and worn consistently, and loose slippers are to be avoided. When flexion contractures have occurred, active and passive exercises in conjunction with repeated plaster casts made in increasing extension may help to correct contracture. If ankylosis is to be the end result, it is of the utmost importance that the affected joint becomes ankylosed in the optimal position for use. The knee should be extended to 180 degrees; the hip in straight position; the wrist in middorsal flexion half way between pronation and supination, and the elbow flexed at about 90 degrees. When deformities due to ankylosis have occurred, surgical measures may be of great value. Such surgical procedures should be done when the activity of the disease has subsided.

Physical therapy and spa therapy are useful for many types of arthritis. Baths and exercises in warm pools sometimes are helpful. Heat in the form of poultices, melted paraffin baths, baking lamp or diathermy often is comforting but is not curative. In fact, in the case of acute disease local heat sometimes is not well tolerated. The most useful forms are simple measures such as the application of heat and muscle exercises which can be performed at home daily by the patient after a minimum of instruction. Violent massage and strenuous passive exercises are poorly tolerated, and all such therapy should be confined within limits of pain and fatigue. Occupational therapy can be of great assistance in awakening the patient's interest in exercising important groups of muscles.

The training of crippled patients to make the greatest use of their limited capacities is important in the severely disabled.

Roentgen therapy is of considerable value in rheumatoid spondylitis but not in rheumatoid arthritis of peripheral joints. Roentgen therapy, when combined with general care, proper exercises and the preservation of an erect posture, by braces if necessary, will cause a symptomatic remission in over 80 per cent of patients with rheumatoid spondylitis. This is characterized by decrease in pain and stiffness and increase in mobility of the spine. It is of interest that although the patients have relatively few subjective symptoms of pain and stiffness, roentgenologic changes and increasing rigidity of the spine continue to progress.

Well controlled studies have not been made on the incidence of rheumatoid arthritis in various parts of the United States or on the effects of climate on the disease once established. One can say, however, that, other factors being equal, it seems wise for patients with rheumatoid arthritis to avoid the northern winters when economic and other factors do not make such a move a greater hardship.

Degenerative Joint Disease

This common articular disorder has been variously named osteoarthritis, hypertrophic arthritis, senescent arthritis and, by certain European writers, arthritis deformans.

The causation of degenerative joint diseases is unknown.

The earliest symptoms usually are insidious mild stiffness and aching pain in or about the affected joint. Fever, leukocytosis, malaise, loss of weight, cachexia or other constitutional manifestations are lacking. Physical signs are inconspicuous at first, but even though there may be no visible changes, passive or active motion, especially in the extremes of range, may reproduce pain. Palpation of the joint during motion may elicit crepitus. Tenderness may be noted at the articular margins. As the disease progresses there is gradual firm or hard, irregular enlargement of the affected joints, although there also may occasionally be slight thickening of the soft tissues. Tenderness will then commonly be found over the periosteal-synovial junction and there may be spasm and tenderness of the associated muscles. Rarely, and in cases of severe disease, one may feel a moderate degree of local

edema and increased warmth especially after excessive use of the joint. In the terminal interphalangeal articulations of the fingers the onset occasionally may occur in the form of a fairly sudden, tender, fluctuant swelling, often mistaken for an infection. Generally, articulations which are subject to greater strain, such as the knee and hip joints and the lower spinal articulations, become involved first and to a greater degree. For unknown reasons, the elbows, wrists and ankles are much less frequently affected. Degenerative joint disease is seen much oftener in the terminal than in the proximal interphalangeal joints. While, therefore, one may anticipate certain sites of predilection, the localization of the disease affords no absolute diagnostic criterion, since cartilage in any joint and throughout the body is subject to the same deteriorative process.

Whereas pathologic evidence of degenerative joint disease can be found in young adults and, to be sure, at any age without noteworthy symptoms, clinical manifestations usually do not occur in significant numbers of patients until the latter part of the fourth and beginning of the fifth decade of life.

The most rational therapeutic measures are those providing rest for the affected part. The means to insure this should be applied to the individual joint with a view to its peculiar stresses in weight bearing and motion. In the case of a peripheral articulation of the upper extremity, simple splinting usually is sufficient. In joints of the lower part of the spine, legs and feet, additional measures to relieve strain and weight bearing may be necessary. Support to various parts may be provided by strapping, belts, braces or by the use of canes or crutches. For more severe degenerative disease of the hips and lower part of the spine rest in recumbency with or without traction may be required.

Physiatric measures are valuable in the correction of malpostures which act as contributory factors and in the treatment of degenerative joint disease. During especially painful phases such measures should be confined to applications of heat in a simple form, preferably hot soaks, hot towel packs or infra-red light, accompanied by stroking massage of the periarticular tissues and muscles. After a few days, when the lesion has become quiescent, passive motion should be added before a gradual return to active exercises and normal function. Roentgen therapy has been advocated for the relief of pain, but its benefit is unproved and its use for this purpose in degenerative joint disease unjustified when satisfactory relief can be obtained by safer means.

Characteristics of the Thigh Muscles with a Double Action

J. E. Markee and Maude Williams, Dept. of Anatomy, Duke University School of Medicine, Durham, N. C., and Division of Physiology, Women's College of University of North Carolina, Greensboro, N. C. In FEDERATION PROCEEDINGS, 8:1:106, March 1949.

Previously, evidence was presented that muscles which pass over the knee and hip function as double muscles; one part shortens to move the hip; another part shortens to move the thigh. This different participation of the separately innervated areas of the biceps femoris, semitendenosus, semimembranosus, rectus femoris, sartorius and gracilis occur during (1) direct stimulation of the nerve branches; (2) reflex flexion and crossed extension elicited in decerebrate preparations; and (3) flexion and extension induced by cortical stimulation. In the present investigation, evidence is presented indicating that these thigh muscles which act as double muscles possess the functional characteristics of simple flexor and extensor muscles. That is, one part of the biceps femoris flexes the knee and resembles a simple flexor muscle in that it fatigues rapidly and develops less tension per unit of weight. In addition the development of effective tension occurs through a longer proportion of the range of shortening of the fibers. On the other hand, the part of the biceps femoris which extends the hip resembles muscles which are simple extensors in that this part fatigues less rapidly and develops more tension per unit of weight. In addition the development of tension is more dependent on the length of the fiber in the extensor portion of the muscle. The flexor and extensor portions of the semitendenosus and gracilis respectively possess these flexor and extensor characteristics.

The Effect of Handometer Exercise Upon Normal Grip Strength

Eleanor M. Larsen (introduced by W. J. Meek), Dept. of Physiology, University of Wisconsin Medical School, Madison. In FEDERATION PROCEEDINGS, 8:1:91, March 1949.

The usual grip strength of normal individuals is determined largely by their occupation. If normal grip strength may be increased by Handometer exercise, the hand strength of individuals weakened by injury or disease might be expected to improve by employing the same method. The purpose of this investigation was to determine the effect of Handometer exercises upon normal grip strength. The usual hand strength of 14 young adult women, right-handed with one exception, was measured by a grip dynamometer before and after 20 bouts of work performed bi-weekly. The exercise apparatus was the Handometer which consists essentially of a sphygmomanometer-type hand bulb attached to an adjustable air-pressure system gauge. The work of compressing the bulb against a constant resistance of 30 lb. pressure was continued at the rate of 60 contractions per minute until the needle could no longer be held constant. The number of contractions was counted and recorded for each hand. The results for every subject consist of 3 grip dynamometer readings for each hand pre- and postexercise, and 20 sets of Handometer data for each hand. The grip dynamometer data were analyzed statistically. The results indicate that the usual right hand grip strength is stronger than the left and that the Handometer exercise increased the grip strength in both right and left hands, with a slightly greater increase in the strength of the left hand.

The Response of Psychoneurotic Patients and Normal Men and Women to Brisk Submaximal Exercise

Elizabeth B. Franseen, Ph.D., Jacob E. Finesinger, M.D., and Arthur L. Watkins, M.D., Boston. In ARCHIVES OF PHYSICAL MEDICINE, 30:4:219, April 1949.

Normal healthy untrained men and women show wide variations in production of lactic acid and in respiratory, circulatory and metabolic determinations during and after three minutes of work equal to 2,079 and 1,287 Kg.-M., respectively.

Psychoneurotic patients in age, build and exercise history similar to the normal subjects also vary widely in the physiologic response to exercise. They demonstrate in most functions studied a greater variability about their means than do the normal subjects, but the means for the groups are essentially the same as those of the controls.

During exercise and early recovery, the patients present average values for ventilation and heart rate closer to those for the normal groups than they did before the exercise.

In the men the production of lactic acid appears to be quantitatively related to the ventilation coefficient (O_2/P.V.), whereas in the women it is more directly related to the excess amount of oxygen used during exercise and recovery and is independent of the actual pulmonary ventilation.

The women, both controls and patients, showed themselves to be less fit for moderately hard activity than were the men, both controls and patients, even though their work load was less than that set for the men.

Treatment of Poliomyelitis Involving the Respiratory System

Harold E. West, M.D., Head Resident Physician, and Albert G. Bower, M.D., Clinical Professor of Medicine and Chief of Service, Los Angeles, California. In THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, 217:3:252, March 1949.

1. The management of patients suffering from poliomyelitis with respiratory involvement requiring the use of a respirator has been presented.

2. The indications for, and the type of tracheotomy preferred, have been described. The value of performing an early tracheotomy has been stressed.

3. Prevention of mechanical difficulties which arise from time to time in the management of patients suffering from acute poliomyelitis and in a respirator cannot be overemphasized. Adequate nursing care is essential.

4. In our opinion, the treatment described here definitely has reduced mortality at least 50 per cent in cases of acute bulbar poliomyelitis in the respirator and having had a tracheotomy performed.

Physical Treatment of the Hemiplegic Patient in General Practice

Harold Dinken, M.D., Denver. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:18:1255, April 30, 1949.

During the past several decades spectacular advances in the preventive and therapeutic aspects of medicine have resulted in a greater life expectancy for the general population. Physicians have been faced with the responsibility of caring for an ever increasing number of patients with chronic disease processes common to later life. Cerebrovascular lesions with their resultant motor disability are prominent among this group; yet, for the most part, the problems of the hemiplegic patient remain unsolved.

The general practitioner of medicine is primarily responsible for the care of this large group of hemiplegic patients. It is essential that he face this task with realistic optimism, for much can be done to help restore these persons to lives of independence and productivity.

Basically, the prognosis will depend on the nature, size and location of the lesion. Age, sex and side involved, in themselves, are not of great importance. In addition to prolonged flaccidity, several other factors adversely affect prognosis. These include severe emotional disturbances of psychotic phenomena, lack of motivation, presence of associated disease, such as chronic nephritis, diabetes and syphilis, and previous "strokes." Prognosis also is adversely affected by delay in institution of physical treatment and by the development of contractures and deformity. Functional recovery, as a rule, is best in the group of patients in which thrombus formation is the causative factor, poorer in the hemorrhage and embolic groups.

Functional capacity does not correlate well with return of motor power. It usually is slower in returning than is motor power. Function returns earlier and to a greater degree in the lower extremity as compared with the upper extremity. The proximal segments in a given extremity return sooner than the distal ones.

The aims of physical treatment in general are to improve motor function, increase functional capacity, prevent or correct deformity and provide for the over-all adjustment of the hemiplegic patient to the demands of daily life. In accomplishing these aims, the practitioner may utilize a wide variety of agents or technics of physical medicine, which embraces the fields of physical therapy, occupational therapy and rehabilitation.

There are three basic considerations in planning treatment. They are: (1) when to start physical treatment, (2) the measurement of disability and progress and (3) the proper selection of the agents or technics to be used.

Treatment should be instituted as soon as possible. In the majority of cases it can be started within the first week following onset. There are few medical contraindications to early treatment in most cases, especially to passive movement of the involved extremities daily, which is particularly important. The fear of producing extension or reactivation of the cerebral vascular lesion is apparently without justification, as indicated by clinical experience.

Much of the crippling deformity seen in this group of patients can be avoided by early adequate treatment. The common occurrence of contractures about the shoulder joint, the so-called "frozen shoulder," can be avoided as can the flexion deformities of wrist and fingers, the externally rotated hip, the flexed knee and the dropped foot.

There are three principal indications for the use of heat in hemiplegia. They are the presence of pain, spasticity and edema. Any form of heat, therapeutically active, will suffice, although many patients seem to fare better with moist heat in the form of hot packs. Heat should be followed by massage, especially if edema is present. Aside from these limited indications, heat and massage are of little value. It is infinitely more important to devote time to the functional program of retraining and movement reeducation.

Movement reeducation is of prime importance. It must be done carefully, indicating to the patient origins and insertions and type of movement desired. Often, reciprocal motion or use of the good extremities first will be of help. It is surprising how very frequently movement is possible even though the patient, on direct questioning, denies ability to use the part. Walking reeducation should be graduated as progress is made. As a general rule, when the quadriceps can function against gravity and there is sufficient stability at the hip and ankle, the patient should be gotten up. Every attempt should be made to make the patient ambulatory as soon as possible. Some mechanical aid may be required, at first, in the walking program. Postural and balance training should be incorporated in the program.

Pulley exercises are of great value in the treatment of the hemiplegic patient. They offer reciprocal motion which is invaluable in relearning. Secondly, they permit adequate stretching of contractures, such as occur in the shoulder. The patient is responsible for the movement and hence does not fear the pain of passive stretching done by someone else. An additional increment of several degrees of motion frequently can be obtained.

Effects of Whirlpool Bath With and Without Agitation on the Circulation in Normal and Diseased Extremities

Lewis Cohen, M.D., Gordon M. Martin, M.D., and Khalil G. Wakim, M.D., Mayo Clinic, Rochester, Minn. In ARCHIVES OF PHYSICAL MEDICINE, 30:4:212, April 1949.

The effects of temperature and agitation in whirlpool bath therapy on the blood flow of normal, flaccid or atrophic upper extremities of 20 subjects were studied by means of the venous occlusion plethysmograph. Paired determinations (with and without the use of agitation of the water) under identical conditions reveal the following facts:

(1) The blood flow in normal and diseased extremities which were immersed in a whirlpool bath with agitation at 38.6 C. and at 41.0 to 42.5 C. did not differ significantly from that following immersion without agitation.

(2) Immersion of the normal and diseased upper extremities at 38.6 C. is followed by a slight increase of blood flow, which is maintained for approximately forty-five minutes.

(3) Immersion of the normal upper extremity at 41.0 to 42.5 C. is followed by a marked increase of blood flow, which is maintained for approximately fifteen minutes after treatment and a slight increase for the following thirty minutes.

The Postural Pains of Pregnancy—Part I—Parietal Neuralgia of Pregnancy

Lowell F. Bushnell, M.D., Los Angeles, California, Chief of the Department of Obstetrics and Gynecology, Wm. E. Branch Clinic. In WESTERN JOURNAL OF SURGERY, OBSTETRICS AND GYNECOLOGY, 57:3:123, March 1949.

The description, diagnosis and treatment of a postural pain of pregnancy has been presented. Adequate application of these findings will make pregnancy more comfortable in many women, but more advice on posture and physical exercise prior to the age of parturitive activities will be of benefit to the future obstetrical patient.

Physical Treatment of Poliomyelitis: Responsibilities of the Physician in General Practice

Robert L. Bennett, M.D., Warm Springs, Ga. In JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:16:1053, April 16, 1949.

No known method of treatment, chemical or physical, can appreciably alter the patterns of destruction wrought by the invasion of the virus in the central nervous system during the acute stage of the disease. The extent of recovery obtained in any individual patient still depends on the physician's ability to make the most effective use of those neuromuscular units left intact after all inflammation has subsided in the central nervous system. To this end great progress has been made, particularly in the physical treatment of the convalescent stage, but the more that is known about the treatment of the after-effects of this disease during convalescence, the more difficult it becomes. The increasing success of such treatment has been due to the development of highly refined routines of care which must be carried out with great precision over long periods of time.

However, no magical formula for mixing together heat, massage and exercise has been discovered. The value of physical treatment is completely dependent on the ability of the physician first to evaluate the specific needs of his patients and, on the basis of this knowledge, then outline the individual programs of care. No physician should undertake the care of convalescent poliomyelitis unless he thoroughly appreciates the responsibilities that he must assume and the physical tools with which he must work to fulfill these responsibilities.

First of all, the physician must be able to evaluate accurately the site and extent of neuromuscular involvement. No form of treatment can be intelligently prescribed unless based on this knowledge. The strength of individual muscles and muscle groups can best be determined by the so-called manual muscle strength test. This test is one of the diagnostic measures utilized by physical medicine and is based on the ability of the patient voluntarily to contract specific muscle groups so that the bodily segments activated by these muscles move through specific planes of motion against known resistance. These tests are accurate and trustworthy only when performed by the physician or therapist skilled in functional anatomy and kinesiology.

All physicians should be able to make a consistently accurate muscle test or, at least, be able to understand thoroughly the results of such a test when done by another physician or therapist. This test is part of the data absolutely necessary for the intelligent use of such physical agents as muscle reeducation, gait training and the use of assistive, supportive and protective apparatus.

At the present time, no other type of test will give us the practical information as does the manual muscle strength test.

The physician must next be able to obtain effective action of all remaining neuromuscular units, either through his own personal use of physical treatment or through his prescription to the trained therapist. Effective use of the intact neuromuscular units can be accomplished only by therapeutic exercise in the form of specific muscle reeducation, followed by the specific functional retraining of bodily segments. In the moderately or severely involved patients, such treatment must be carried out intelligently and meticulously over many months or even years. It is this phase of treatment that forms the keystone of the over-all program of care. Unless the involved muscles are trained to work coordinately and with maximum strength and endurance, the most effective use of the neuromuscular units left intact after the initial damage to the central nervous system never can be realized.

The physician must next be able to anticipate and correct or minimize the factors responsible for musculoskeletal deformities. It is true that one can do nothing to prevent the weakness and atrophy that must follow actual denervation of muscle fibers, but one can and must prevent the structural changes that develop in bodily segments inadequately supported.

These faulty positions may occur during periods of so-called rest if the segments are held in abnormal alinement by such factors as weakness, pain and muscle spasm. Here, physical medicine combats such distortion by supporting weakened segments in normal alinement by pillows, sand bags and, when necessary, light splints that can be easily removed to permit the application of other forms of treatment. Pain can be relieved and spasm released by the intelligent use of heat, massage and passive motion. The use of hot packs has been widely advocated, but many other forms of heat, if properly applied, will give similar results. In some cases, massage is soothing and relaxing and should be used even in the acute stage. In other cases, massage is irritating and cannot be used with beneficial effects until the inflammation in the nervous system has quieted down. Passive motion probably is the most important single factor in physical treatment during the early convalescence because it helps prevent contractures of muscular, ligamentous, fascial and periarticular structures, assists venous and lymphatic circulation and establishes reflex tone in reinnervated fibers. Like all other valuable therapeutic measures, it may be harmful if used carelessly and too vigorously.

The physician must not only be capable of noting the earliest deviations from normal patterns of motion and weight bearing but also must be capable of correcting or minimizing these faults through functional training and, when necessary, the use of assistive and supportive apparatus, such as corsets, braces and crutches.

Finally, the physician should appreciate the frequent need for, and value of, certain orthopedic surgical precedures during the convalescent stage.

Physical medicine must not be thought of as in competition with orthopedic surgery. It is essential that the physician caring for the convalescent phase of this disease foresee the possibilities of later surgical procedures and through his treatment maintain the involved segments in such condition that, if necessary, the surgeon can add to the patient's greater functional capacity and security at the optimum time in the over-all program for maximum rehabilitation.

Physical Therapy Unit That Ingenuity Built

A. H. Brittingham, Executive Director, Easton Hospital, Easton, Pa. In THE MODERN HOSPITAL, 72:4:68, April 1949.

Treatments are all prescribed by the physician and may extend over a period of days, weeks, months or even years. If swelling, pain and lack of motion occur following removal of casts, a series of physical medicine treatments is ordered. These treatments consist of heat followed by massage and manipulation.

War Injuries of Peripheral Nerves

H. J. Seddon, Director, Institute of Orthopedics, Royal National Orthopedic Hospital, London. In THE BRITISH JOURNAL OF SURGERY, 143:2:325, January 1949.

Nonoperative Treatment of Nerve Injuries

Pre-occupation with the operative repair of damaged nerves has sometimes resulted in neglect of the nonoperative treatment. Yet even if operation were invariably required—and this is by no means so—satisfactory restoration of function still would depend very largely on the physical treatment of the affected part.

Maintenance of Mobility: As was forcibly pointed out by Ritchie Russell and Harrington (1944) the maintenance of mobility is imperative. There are few situations more discouraging than being called on to undertake what promises to be an easy repair of a damaged nerve in an arm where disabling stiffness of the wrist and fingers has been allowed to develop. There are two chief causes of stiffness—edema and muscle shortening.

The return flow of lymph from a limb depends almost entirely on muscular activity, and if, as a result of widespread paralysis, edema is allowed to occur it will not be long before stagnating lymphocytes become transformed into fibroblasts which, in turn, cause deposition of collagen throughout the soft tissues. In the moving parts—muscles, tendons, and joints—those ubiquitous cobwebs of collagen cause grave restriction of mobility: they are one variety of what are called "adhesions."

The second cause of restriction of movement, muscle shortening, is of two kinds. A normal muscle may shorten at the expense of a paralyzed and unprotected antagonist, a fact so well recognized that deformity and stiffness from this cause are rarely seen. But paralyzed muscle also may become shortened. Denervated muscle, especially if it has not been treated regularly by electrical stimulation, undergoes progressive interstitial fibrosis and, given opportunity, the fibrotic muscle will develop a contracture. The opportunity is provided when the paralyzed muscle is splinted in full relaxation and regular passive movements of the joints it controls are neglected.

Another cause of stiffness, that of joints, is more difficult to explain. If the paralysis is widespread and edema has occurred, every part of the joint disabling stiffness can develop when the paralysis is limited to one muscle group and there has been no demonstrable edema; the best-known example is restriction of movement at the metacarpophalangeal joints in a case of radial paralysis that has been splinted improperly, with these joints in extension. It is independent of the shortening in the finger extensors. The lateral ligaments become shortened, and sometimes nothing less than excision of them will permit reestablishment of movement.

Fortunately, the prevention of stiffness, whatever the cause, is a fairly simple matter; the development of edema must be forestalled and the normal length of all muscles must be maintained. If the paralysis is at all extensive the limb should be kept elevated; and whether the paralysis be widespread or not every joint in the affected part should be put through the fullest possible range of movement several times a day, actively or passively, the only limiting factor being the immobilization required for the healing of the wound or fracture. The early and widespread stiffness following serious injuries of the brachial plexus often is regarded as inevitable. It is not: provided that movements are started early and that the limb is placed on an abduction frame perfect mobility in every joint may be retained.

The importance of maintaining full mobility cannot be overemphasized and in the absence of skilled care—as, for example, when a patient has to make a long journey by hospital ship—the patient himself must be instructed to keep the part moving, supplementing active movements with passive manipulations as required.

The practice of splinting paralyzed muscles in a position of relaxation is based more on tradition than on scientific knowledge, and until the latter is more complete we shall continue to see wide variations between the practice of one surgeon and that of another and even inconsistencies in individual technic.

Without going too deeply into the subject it is, perhaps, sufficient to say that splinting is desirable only for preventing over-stretching of a paralyzed muscle or other structure.

If passive movements are important in the unsplinted limb they are even more necessary for one that is splinted. Removal of the splint two or three times a day is imperative and on each occasion every joint in the part should be put through a full range of movement.

Electrical Stimulation of Denervated Muscle: Although the effect of electrically induced exercise on denervated muscle has been investigated many times, the results of much of this work have been conflicting; in consequence clinicians have been reluctant to employ an expensive, time-consuming, and uncomfortable form of treatment when there was still doubt as to its value. It remains to be seen whether stimulation is equally effective in preventing wasting in large masses of muscle, since a tolerable stimulus does not affect all parts of a large muscle mass equally, the deep fibers tending to escape altogether.

At each of the nerve injury centers provision was made for the rehabilitation of soldiers and airmen suffering from nerve injuries, and all sorts of occupations were introduced in the endeavor to obtain the best possible functional results. Carpentry, leatherwork, weaving, clay modeling, and sign-writing proved of great value, and in many cases the results were such that patients were able to return to duty in a high medical category. But, for the reasons already given, the finer grades of muscle coordination and sensory discrimination were not regained after nerve injuries requiring operative repair, though even in these cases return to duty often was possible.

Causation and Treatment of Painful Stiff Shoulder: Subdeltoid Bursitis, Periarthritis, Tendinitis and Adhesive Capsulitis

H. W. Meyerding and J. C. Ivins. In ARCHIVES OF SURGERY, 56:693-818, June 1948. Abstracted in JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 139:16:1110, April 16, 1949.

Meyerding and Ivins present clinical observations on 150 consecutive cases of stiff painful shoulder, in which manipulation with patient under anesthesia, surgical excision of calcified plaques or bursas, injection or needling was performed at the Mayo Clinic during the years 1942 through 1946. The duration of symptoms varied, but in 65 it was of less than a year. Roentgenographic examination revealed calcification in 59 cases and osteoporosis in 34. Since the evidence of calcification depends on the degree of deposit, calcification doubtless was present in more cases. Pain, stiffness and local tenderness were the characteristic symptoms, and they often followed some exertion, such as gardening, painting and washing walls. The pain usually was intermittent. The patient with the acute stage of the disease or with intense pain, local tenderness, slight fever and the arm maintained at the side for protection may be treated for a few days by rest in bed, local application of heat, increased intake of fluid, maintenance of elimination and traction, together with administration of anodynes. Abduction should be encouraged,

and conventional diathermy and roentgen therapy may be included, after which patients often are relieved. The authors discuss the treatment to be employed in the subacute and recurrent attacks. In 69 of the 150 cases manipulation with the patient under anesthesia was performed; in 32 additional cases manipulation with injections of procaine hydrochloride into the suprascapular nerve was used; in 31 a needling operation was performed, to pierce and break up the calcareous deposits, and in 18 surgical excision of the calcareous masses was performed. Forty of the 150 patients received roentgen therapy in addition to other treatment, some of them prior to admission at the clinic. Acute lesions have proved more amenable to roentgen treatment than have the more chronic lesions. The authors present detailed reports of 9 patients to illustrate certain points in diagnosis and treatment. By following the procedures outlined in this paper, satisfactory functional results have been obtained in 85 per cent of the cases.

Present-Day Education in Physical Medicine

William Bierman, M.D., New York City. In NEW YORK STATE JOURNAL OF MEDICINE, Vol. 49, No. 8, April 15, 1949.

The Physical Therapist: The term "physical therapist" is now applied to the technician in this field. Formerly it was employed to designate the physician-specialist who is now called a "physiatrist."

A review of the curricula required and suggested for the physical therapist, occupational therapist and the physical education therapist shows that all three must spend a considerable percentage of their time in learning the same subjects, such as anatomy, physiology, kinesiology, psychology and hygiene. The possibility of training one individual in all three of these technical branches should be considered. A technician so educated would be better able to comprehend the advisability of applying one technic rather than another in the treatment of a given patient. She also could be of service to smaller institutions unable to afford several technicians. A curriculum covering a period of four years could act as a basic one. A graduate could then specialize further in that division in which she desires to become more proficient. A four-year course such as that indicated, because of its technical nature, may prove attractive to many high school graduates who desire to enter into some phase of medicine and are not attracted to the field of nursing.

There are objections to this plan for the training of the physical therapist. It is doubtful whether, in view of the present educational concept of the necessity for the incorporation of so-called "cultural subjects" in courses leading to a degree, any university would issue one to a student who devoted her time to the acquiring of knowledge which would be considered as almost exclusively vocational.

Mechanical Aids for Patients with Muscular Disability

Paul Thomas Young, Ph.D., Urbana, Illinois. In THE JOURNAL OF BONE AND JOINT SURGERY, 31-A:2:428, April 1949.

The writer has had experience with several cases of a rare form of muscular dystrophy in which there is a generally retarded muscular development. With advancing age and increasing weight, the difficulty of locomotion is augmented. Arising from a chair of ordinary height becomes an arduous task. Going up stairs is laborious. With one patient, if the rise is more than seven inches, the step cannot be mounted without assistance.

To aid in meeting these difficulties, various mechanical aids have been evolved, through trial and error over a period of about thirty years. The present report describes two forms of secondary aids—stepping-stick canes and self-rising chairs.

A Comparative Study of the Temperatures Produced by Microwave and Short Wave Diathermy

James W. Rae, Jr., M.D., J. F. Herrick, Ph.D., Khalil G. Wakim, M.D., Ph.D., and Frank H. Krusen, M.D., Mayo Clinic, Rochester, Minn. In ARCHIVES OF PHYSICAL MEDICINE, 30:4:199, April 1949.

A comparison was made of the temperatures produced in the tissues of trained dogs by four short wave diathermy machines and two microwave directors. Temperatures were measured by means of a thermistor and needle thermocouples and were recorded on a moving photographic film. Temperatures were determined after ten, twenty and thirty minutes of radiation.

The following observations were made:

(1) Before heating, the temperature gradient was from within outward—that is, from the warmer muscle to the less warm subcutaneous tissues and skin.

(2) After heating with microwave or short wave diathermy, this temperature gradient remained the same; from the superficial muscle layers to the skin. However, in muscles the gradient was reversed; from the warmer superficial layers to the less warm deeper layers.

(3) There was considerable variation in the temperatures produced by the different short wave generators.

(4) With the technics and dosages used in this study, the differences between the temperatures produced in the deep tissues by microwave director A and by some short wave generators were not significant.

(5) Higher temperatures were obtained after twenty minutes of heating with microwave director A than after thirty minutes of such treatment. This phenomenon was not seen when short wave generators were used.

(6) Immediately after short wave diathermy, the temperatures of the deep muscle (3 cm. in depth) rose for a variable number of minutes. This phenomenon was not observed after treatment with microwaves.

(7) The ratio of the increase of temperature in the deep muscles to that in subcutaneous tissues was higher after microwave than after short wave diathermy.

A New Device for Measuring Muscle Strength: The Myometer

Louis B. Newman, M.E., M.D., Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Hines, Illinois. In ARCHIVES OF PHYSICAL MEDICINE, 30:4: 234, April 1949.

The myometer, a new device for accurately measuring muscle strength, is described. It measures the resistance offered by a muscle in isometric contraction, the reading on the gauge being equal to the force necessary to overcome the isometric contraction of the muscle under test. It is extremely important when repeating muscle tests to use identical procedure and technic in order to assure identical conditions. Different physicians or therapists using the myometer on the same muscle or muscle groups with the same technic will secure practically identical results for the muscle strength readings.

This device is self contained, is light in weight and gives a direct reading. A maximum reading pointer eliminates the necessity of watching the gauge during the test, enabling the observer to concentrate on the muscle action. The three different ranges permit testing to be done up to a force of 60 pounds, which should adequately cover the ranges of muscles with subnormal strength. When desired, the myometer can be held in a clamp fastened to or pivoted from a table, stand or similar support.

The myometer is a valuable adjunct, leading to a more precise and scientific evaluation of impaired neuromuscular function and a more accurate determination of the effect and value of prescribed treatment.

Practical Aspects of Cerebral Vascular Accidents

H. Houston Merritt, M.D., Columbia University, New York City. In NEW YORK STATE JOURNAL OF MEDICINE, 48: 2371-2378, 1948.

After recovery from the acute phase, therapy is directed toward restoration of function in the paralyzed limbs. Light massage and passive movements are begun. The patient is encouraged to use paralyzed muscles.

Unduly prolonged exercise is fatiguing and discouraging to the patient. As muscular activity returns, increasing degrees of active exercise are introduced. As soon as advisable, the patient is allowed in a chair for progressively longer intervals. Graduated instruction in exercise and walking is begun with a view to making the patient as self-sufficient as possible.

Aphasia or disorders of speech require patience and persistent effort. Best results are obtained when reeducation is under the supervision of a trained speech therapist.

Book Reviews

The Strapping of Athletes. *By Edward D. O'Donnell, Physical Therapist, Department of University Health, Yale University; Supervisor of Athletic Trainees, Yale University Athletic Association. Paper. Price, 50c. Pp. 33, with 38 illustrations. The Seamless Rubber Company, New Haven, Conn., 1949.*

The essential subject in this booklet is a description of the technic of application of athletic tape to various parts of the body in such a manner that further damage to this part is minimized and that prompt healing is promoted.

It is assumed that any group of athletes has a physician responsible for their physical care. The physician should establish the diagnosis and plan the treatment. The application of strapping probably would be carried out by the trainer. The methods of strapping in this booklet are well illustrated and the margins of the tape are specially outlined to show more clearly the strapping method.

Atlas of Human Anatomy: Descriptive and Regional. *By M. W. Woerdeman, M.D., F.R.N.A.Sc., Professor of Anatomy and Embryology, and Director of the Department of Anatomy in the University of Amsterdam. Volume I—Osteology, Arthrology, Myology. Cloth. Price, $12.50. Pp. 512, with 512 illustrations. The Williams and Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, Md., 1948.*

Existing atlases consist mainly of suitable drawings for the study of descriptive anatomy, but do not pay sufficient attention to regional anatomy. The main guiding principle of the author throughout this atlas has been that each separate plate should depict a concrete example with all its individual features.

By comparison of the various plates in this atlas and with his own dissections, the student will be able to get an impression of the individual variation existing in the human body. Reproductions of specimens from children have been included where the structure of a particular organ differs to any extent from that in the adult.

This book is recommended as an aid in teaching anatomy to physical therapy students and as a reference for physical therapists.

How to Live Longer. *By Justus J. Schifferes, Ph.D., Recently Associate in Hygiene, Columbia College. Formerly Instructor in Health Education, Teachers College, Columbia University. Foreword by Ralph F. Sikes. Cloth. Price, $3. Pp. 256. E. P. Dutton and Company, 300 Fourth Ave., New York 10, 1949.*

This is a hopeful book. It will serve to eliminate false and groundless fears about many conditions. The principal causes of death are quite a different listing from those which we had a half century ago. On the other hand, as our population has aged, the degenerative diseases, such as heart disease and cancer, have risen in importance both as personal and public health problems. This book is valuable for the person who wishes to understand clearly his own risk from those diseases without pouring through the great mass of scientific literature which bears on these problems. This book should prove a great help.

A Method of Anatomy: Descriptive and Deductive. *By J. C. Boileau Grant, M.C., M.B., Ch.B., Professor of Anatomy in the University of Toronto, Toronto, Canada. Fourth edition. Cloth. Price, $7. Pp. 852, with 800 illustrations. Williams and Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, Md., 1948.*

Many parts of this new fourth edition have been rewritten and the text has been thoroughly revised. In order to facilitate easy and rapid reference more bold face type and many more headings and subheadings have been used than in former editions.

New illustrations have been added to bring the total to 800 and over 60 of the old ones have been redrawn or otherwise improved. The method still emphasizes the correlation of facts and their presentation in anatomical regions. The original diagrammatic drawings still play their vital part in interesting fashion and in developing the ability to reason anatomically.

Detailed Atlas of the Head and Neck. *By Raymond C. Truex, M.S., Ph.D., Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University, New York, and Carl E. Kellner, Artist, Department of Anatomy, College of Physicians and Surgeons, Columbia University. Oxford Medical Publications. Cloth. Price, $15. Pp. 162, with 136 illustrations. Oxford University Press, 114 Fifth Avenue, New York 11, 1948.*

This is a culmination of the combined abilities of two people in the Department of Anatomy of Columbia University. This volume is specifically designed to aid both the practitioner and student to obtain an understanding of the intrinsic anatomy of the head and neck. Several views of each region are included which may be correlated by consulting cross references. The drawings were all made directly from original regional dissections. Physical therapists will be particularly interested in the excellent illustrations of the various layers of face and neck muscles which show in detail the innervation and blood supply.

Highly original dissections show the relations of the brain stem, cerebral nerves and vessels to meninges, foramina and fossa of the skull. There is a series of dissections of the basal, lateral and medial surfaces of the brain which gives the student a conception of the fiber tracts that underlie the surface of the cortex and of the continuity of conduction paths between the cortex and the cerebral peduncles. This section of this atlas would serve the physical therapist as a valuable reference in the study of neuroanatomy.

The Hospital Building: Comprising the 1947 A.I.A. Convention Seminar Addresses on Hospitals, and the Building Type Reference Guide No. 2. *Reprinted from the Bulletin of The American Institute of Architects, May 1947 and January 1948. Compiled and edited by Walter A. Taylor, Director, Department of Education and Research, The American Institute of Architects, Washington, D. C.*

Paper. Price, $2. Pp. 71, with 7 illustrations. Department of Education and Research, The American Institute of Architects, The Octagon, Washington 6, D. C., 1947-1948.

This material, together with additional data from the Bulletin of the A.I.A. is here made available in compact form under one cover, so that not only the architectural profession but other interested organizations and individuals may benefit from its use. In the bibliography on hospitalization on page 64 there is a section on "Physical-Occupational Therapy."

Recent Advances in Public Health. *By J. L. Burn, M.D., D.Hy., D.P.H., Medical Officer of Health and School Medical Officer, Salford, England. Cloth. Price, $6.75. Pp. 409, with 82 illustrations. The Blakiston Company, 1012 Walnut St., Philadelphia 5, 1947.*

The author in this book summarizes the many important advances of nearly two decades in preventive medicine, public health and the individual, the community and the environment. Such important subjects as the public health nursing service, care of the mother and child, housing problems in relation to health, and welfare health problems are fully covered. In the section on public health and the community such subjects as poverty, rehabilitation, infectious diseases, health agencies and international health relations are considered.

The section on public health and environment presents the progress on a wide front, including smokeless air, water purification, swimming pools, milk, food substitutes, refuse disposal, cremation and garden cities.

Pain Syndromes: Treatment by Paravertebral Nerve Block. *By Bernard Judovich, B.S., M.D., Instructor in Neurology, Graduate School of Medicine, University of Pennsylvania; Physician in Charge, Neuralgia Clinic, Graduate Hospital, Philadelphia, Pa., and William Bates, B.S., M.D., F.A.C.S., F.I.C.S., Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Consulting Surgeon, Babies Hospital, and Philadelphia Home for Incurables; Consulting General Surgeon, Wills Hospital, Philadelphia, Pa. Foreword by Joseph C. Yaskin, M.D., Professor of Neurology, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa. Third Edition. Cloth. Price, $6. Pp. 357, with 181 illustrations. F. A. Davis Company, 1914 Cherry St., Philadelphia 3, 1949.*

In the third edition of this book, formerly called "Segmental Neuralgia in Painful Syndromes," the authors have attempted to clarify further the management of certain pain problems. One chapter is devoted to "Posture in Relation to Abdominal Pain and Tenderness and Ptosis of the Abdominal Organs." The authors state that since the main causes of segmental pain and tenderness are primarily excessive lumbar lordosis, scoliosis and spinal arthritis, they searched for the best method of overcoming those postural defects. This led to their adoption of the special exercises devised by Goldthwait and his associates. The problem of the anterior scalene syndrome is approached by the reevaluation of signs and symptoms. Factors are suggested which the authors believe are responsible for failure to obtain relief of pain following scaleniotomy. Distinguishing symptoms and signs of primary and reflex scalene syndromes have done much to help to understand some of the puzzling pain problems affecting the neck, shoulder and upper extremity, and definitely have lowered the necessity for surgical intervention.

Endometriosis as a cause of major backache is presented with case histories. The intravenous use of procaine as a method of pain control is presented with mode of action, indications and technic of administration. A new chapter on atypical facial pain has been added to the book.

Annual Review of Physiology. *Edited by Victor E. Hall, Jefferson M. Crismon, and Arthur C. Giese, Stanford University. Volume XI. Fabrikoid. Price, $6. Pp. 643. Annual Reviews, Inc., and The American Physiological Society, Stanford, California, 1949.*

The appearance of the *Annual Review of Physiology* is an event of major importance. In it are collected the data of a year of progress in the different fields of physiology. The editors have made some changes in the policy of the *Annual Review*. The chapters in applied physiology, exercise, anoxia and the like, will be discontinued. Workers in the field of physical medicine will be sorry indeed to see these chapters disappear from the *Annual Review*. The chapter on physiological psychology will disappear in view of the fact that an *Annual Review of Psychology* will be published. Chapters on pathology will disappear in view of the announced publication of the *Annual Review of Medicine*.

The present book contains an excellent chapter on physiological psychology by H. F. Harlow of the University of Wisconsin. Chapters of immediate interest to those in physical medicine are: "Visceral Functions of the Nervous System" by W. B. Youmans of the University of Oregon; "Somatic Functions of the Nervous System" by H. W. Magoun of Northwestern University; "Muscle" by A. Sandow of Washington Square College; "Peripheral Circulation" by Eric Ogden and C. E. Hall of the University of Texas; "Radiation" by L. F. Nims of Brookhaven National Laboratory, and the chapter on "Permeability" by T. Teorell of the University of Uppsala. The reviews are of the same excellent quality of previous years and no one interested in pure or applied physiology can afford to be without this volume.

In his review of the visceral functions of the nervous system, Youmans discusses the innervation of cutaneous areas as studied by changes in electrical skin resistance. Of particular importance also is the work on afferent fibers in the phrenic nerve. Pain can be transmitted in the phrenic nerve by delta and C fibers only. The afferent fibers in the phrenic communicate with respiratory, cardio-accelerator and vasomotor centers. Data is given on responses of skeletal muscle and cardiovascular responses as a result of stimuli applied to the smallest intestinary nerves. A very excellent review of the present literature on adrenergic neurohormones is given in this chapter, while the literature on central levels of autonomic function is extensively reviewed.

In his chapter on the somatic functions of the nervous system, Magoun reviews the literature on the prefrontal cortex and on the effect of cortical areas. It is particularly important to follow the literature on the second somatic effector area. Electromyographic recording of responses to stimulating the motor cortex supports the principle of multiplicity of muscular representation. The physiology of the cerebellum is a field which is very rapidly changing and which is of considerable importance to practical concepts in physical medicine. The literature on this very difficult subject has been very excellently reviewed. Work on the brain stem and the literature on tremor and spasticity, also the literature on somatic sensation, conclude this very important chapter.

Lloyd and McIntyre review the very extensive literature which has accumulated during the year in bioelectric potentials. Lorente de No's work has been reviewed in this chapter and his evidence for an oxidative origin of the membrane potential has been ably analyzed and discussed. The evidence that the electrotonic potential consists of at least three components, each with its characteristic features, is discussed and the relation of the three parts of the membrane potential to the passage of an impulse is described. The relationship of acetylcholine to nervous conduction has been revived by the appearance of the drug, DFP, and liter-

ature on the controversial subject is reviewed in this chapter. A very able review of the potentials in and about junctional regions concludes this chapter. This chapter is one of the best reviews of some of the very controversial issues in the field that this reviewer has ever seen.

In his article on muscle, Sandow stresses the studies concerned with the fundamental problems of contraction of skeletal muscles. New electrical recording methods of muscle contraction have been reviewed and considerable attention is paid to recent work on the contraction of single muscle fibers. The importance of this work and the discussions which have developed from it cannot be overestimated because no clear understanding of the function of muscle as a whole is possible without appreciation of the physiology of the single muscle fiber. Sandow reviews in detail the excellent work published in recent years by Ramsey and his co-workers. That the author of this review pays considerable attention to the work on latency relaxation is only natural in view of the fact that the recognition of this phenomenon was originally due to Doctor Sandow. A review of the function of the human muscle is found in this article. The very excellent work of Dern is mentioned in passing and should be read by anyone interested in the functioning of muscles in the human body. Modern literature on the chemical aspects of muscle contraction has been reviewed. Electrophysiology of muscle, both from the standpoint of action potentials and excitability, has reopened old problems without giving a very clear solution. The large amount of work which has recently been published on the ultrastructure and mechanisms of contraction has been very ably reviewed and should be read by those interested in the fundamental mechanisms of muscle contraction.

In the article by Ogden and Hall on peripheral circulation, the chapter on circulation in the extremities is of particular importance. The effect of pressure breathing on blood flow through the extremities has been discussed. Physical and chemical effects on the circulation in the extremities have been very adequately reviewed, as are the nervous factors influencing the circulation. Clinical papers which have a bearing on the physiological mechanisms of circulation in the extremities are reviewed. This chapter contains a wealth of information on peripheral circulation.

The chapter on radiation by Nims deals with the general physiological effects of radiation. X-ray radiation and radiation from radio-active materials have been discussed. Some of the recent therapeutic applications of radio-active material are mentioned in this chapter.

The chapter on permeability by Teorell is a very important, fundamental scientific chapter on the all-important phenomenon of permeability. The physical chemistry of membranes and with it, the understanding of nerve conduction and cell and tissue permeability and its relation to metabolism all depends on the clear understanding of the basic principles of permeability. The studies on permeability are by no means limited to those organs with which physical medicine usually deals, but the physiological and physical facts underlying the permeability of the nerve or muscle are the same as those underlying other organs. In many instances, studies can be performed better on those organs and the data obtained are of immediate importance in understanding some of the basic physiology of muscle and nerve.

Obviously, the *Annual Review of Physiology* is not a textbook of physiology; neither is it an exhaustive review of the physiology of certain fields. It is, on the other hand, an analytic summary of the work that has been done in the major fields of physiology during the past year, and as such its value cannot be overestimated. For those of us who realize that the physiology of today is the clinical application of tomorrow, this is one of the most valuable books to study and digest.

Meet Our New Contributors

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Satinsky, Victor P., M.D., 1930 Chestnut St., Philadelphia 3, Pa. Doctor Satinsky graduated from Jefferson Medical College, Philadelphia, in 1938, with an M.D. degree. He served as Thoracic Surgeon with the 34th General Hospital, U. S. Army, 1944-45; as Chief of Surgery, 297th Station Hospital, Berlin, Germany, 1946, and as Prosector in Anatomy, Jefferson Medical College in 1939 and 1941. At present he is Instructor in Surgery, Hahnemann Medical College, Philadelphia, Pa., and on the Surgical Staff, Deborah Sanatorium, Browns Mills, N. J.